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### **08** A PC For The Future

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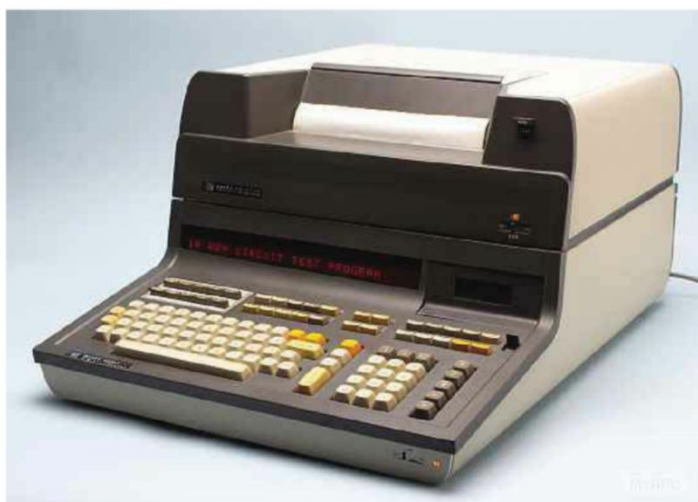


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# Building A PC For The Future

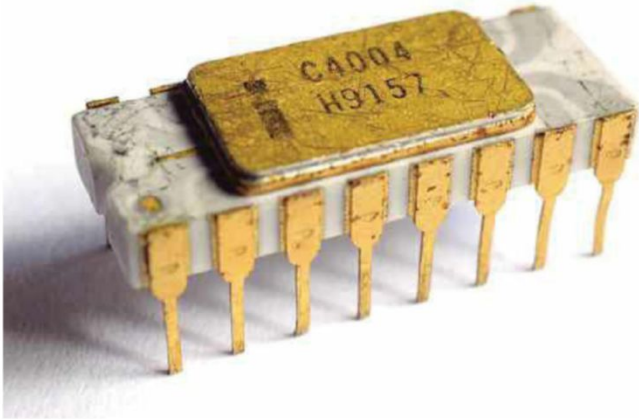
**Mark Pickavance talks about things you might well want to consider if you're considering building a PC in the next six months**

**T**here was a time that choosing the parts for a new PC was remarkably simple, because the choice was so limited. When Intel launched the i486, it only made two versions initially: 25MHz and 33MHz models.

These days, the opposite is true, and you're confronted with a relatively huge range of processors, memory, GPU and motherboards that are widely available.

With so many options, it's difficult to know where to start. I created this small feature to show people preparing to build a new PC what things they might want to consider including and the things they could probably leave out. My suggestions won't fit every scenario, but they should help anyone building something new to strike a decent balance between what's useful now and what could be ideal further down the road.





But first, let's talk about processors and the best choices for those who want longevity for their system.

### The CPU Game

There's a problem with buying processors that stems from the very limited brand options the PC currently has. Specifically, it's Intel or AMD, as most processors made by other companies aren't X86 architecture compatible, and therefore not really a PC.

For a long time, AMD has been trying to compete with Intel, a company that on employees alone is about 12 times larger, and on revenue is about 30 times smaller.

“ I wouldn't think about a mid-term upgrade on the processor for any new PC I was building ”

While chips like the Opteron really demonstrated how far down the wrong path Intel went, since then, it's been all Intel if you want raw performance on a desktop system.

The problem with this dominance is that there's no pressure on Intel to reduce prices or advance performance levels significantly, resulting in a degree of stagnation. These days, we're lucky if we see a 5-10% performance bump for a new generation, and frequently Intel messes with the socket so you can't realistically use new CPUs on other boards and vice versa.

Because of how often it does this, I wouldn't think about a mid-term upgrade on the processor for any new PC I was building. Instead, I'd accept that the CPU placed in it at the outset will probably be the one it will end up with forever.

That does seem to fly in the face of having a socketed processor, but my experience is that when you want to upgrade, you'll find you can't, because Intel has done something to make it either impossible or impractical.

What's particularly irritating is that occasionally it won't change the physical socket, so its old chips will actually go on a new chipset, but they won't work for numerous reasons. So be aware of that.

Because of this, I'd really recommend you look at what Intel has in its Core i5 range when you come to build, because these generally offer the best combination of price and performance.



Unless you have modest requirements, i3 is underpowered, and i7 is not worth the price for the nominal improvement. You can occasionally get deals that might make the i7 affordable, but most of the time you just don't need all those cores and threads unless you're into heavy processing.

Buying today, I'd probably go with a Skylake-cored processor, mostly because compatible LGA 1151 motherboards are relatively cheap, and the Core i5 6500 can be found for less than £200. I'd avoid 'K' class overclockable processors for no other reason than if you want a PC to work for a long time, then just don't overclock it. I'd also avoid Haswell chips for no other reason than they're older technology that costs nearly as much as Skylake for the same core/clock.

When you buy a CPU, you need to think hard about the motherboard to go with it, because the two will only work well if they're considered in parallel.

Some readers might be wondering why I haven't mentioned the AMD Zen processor, which we'll see soon, allegedly. These might be wonderful, but so many times before, AMD promised plenty and delivered much less. It would be good for the PC industry if Zen was a chip that would fire back up the old Intel versus AMD antagonism, but more it's realistic to accept it probably won't. I so hope I'm wrong on this point, because Intel badly needs a big kick up the pants at this time, as much as AMD needs a little success.

### Motherboards

While the brand options might be limited, the motherboard choices for the currently available chips are huge. Intel makes at least six platforms for its current LGA 1151 processors, some being more affordable than others. At the cheap end are the



▲ *AMD has been promising a competitive desktop CPU seemingly forever. Will its new Zen range be that chip?*



▲ The Asus ROG Rampage V Edition 10. An X99 chipset motherboard that costs the best part of £600 and ideally needs a £1,600 processor, which will soon be obsolete when PCIe 4.0 is launched

H110 and B150 boards, and at the top of that food chain is the Z170, which can easily be twice the price.

My advice is to buy the Z170, Q170 or H170 and not any of the others for one critical reason: PCIe lanes. In the cheaper boards, the chipset has fewer PCIe lanes, so the system is reliant on those that come with the processor.

That's fine until you use a discrete video card that needs x16 PCIe 3.0 lanes, and the system is left with virtually no lanes available for anything else. The importance of this can't be overstressed, because if you want the very best storage options (covered elsewhere), then you'll need those spare lanes.

If you wondered why many H110 motherboards don't have many slots, then the answer is that there just aren't the PCIe lanes to support them, and in some situations using a feature that uses lanes may disable some or all of the slots that they have.

Avoid this problem from the outset and pay another £50 for a motherboard with lots of lanes, like the excellent Z170, and don't get stuck with a system that has upgrade problems down the road.

The temptation, if you just got a windfall, might be to go for an X99 LGA 2011-V3 motherboard. Personally, I wouldn't. Few regular users of desktop computers need that sort of power, and everything to do with these systems is overpriced. Yes, they are the quickest systems, and they have the most PCIe lanes, but paying between £200 and £500 for a motherboard, and then at least another £400 to £1,600 for the processor is a mug's game.

## Storage

They might be cheap, but hard drives are slow and use too much power. Any system you're building now should have an SSD, and only a hard drive if you want cheap extra storage. If your budget is tight, a 256GB SATA SSD is relatively inexpensive and can easily hold the Windows OS and a few important apps.

The current version of the Serial ATA interface is SATA-3. And the fastest drives on that interface can read at 550MB/s and write at 520MB/s, which is reasonably quick.

But it isn't the fastest by any standard, because that award goes to NVMe drives that connect directly to the PCIe bus. NVMe drives come either as a self-contained PCI Express card that needs a PCIe x4 slot or as an M.2 NVMe card.

To confuse matters, M.2 can also be used for SATA, where the same performance limitations as SATA-3, so be careful not to confuse the two. Motherboards can come with SATA-3, M.2 NVMe, M.2 SATA or even a new version of SATA called SATA Express.

The one that is getting the most traction is M.2 NVMe, and that requires for lanes of PCIe to provide the bandwidth needed for a single high-performance drive. There seems little evidence that the SATA Express connector that uses two lanes of PCIe is becoming popular or even getting support from drive makers.

Therefore even if you can't afford M.2 NVMe right now, getting either a motherboard with the M.2 slot on it or one with enough spare PCIe lanes so you can drop one in with a cheap M.2 card is the right choice.

The performance these drives deliver is up to six times better than the highest-end SATA SSD you can buy, and they're also very low power consumers compared to conventional SATA drives.

## Video Cards

This is a difficult area to give advice on, because each time AMD or Nvidia comes along with a new generation, they make most of their previous designs obsolete. I myself spent a decent amount on a GTX 960, only to have the better GTX 1050 Ti come along for less within six months.

“ They might be cheap, but hard drives are slow and use too much power ”

Because of those pitfalls, I'd avoid spending any more than £200 on a video card of any flavour, because in less than four years the performance that costs you £500 now will be £150 then. And unless you're a 4K gamer, you won't notice much difference.

I also wouldn't consider using multiple GPUs as a strategic plan, because in this writer's experience if you don't deploy them from the outset, you'll never buy the second card at a later stage. When you come to the point where you want to add that power, you realise that you could put that money towards a new more powerful single card and sell your old one to soften the hit, and get general speed improvements.

It's also worth noting that the latest Nvidia cards only really work in two card combinations and that using multi-GPU mode doesn't always make a game or app faster by default.

Another consideration is that PCI Express, currently at version 3.0 will get a hike in bandwidth in 2017 with the introduction of PCIe 4.0. This jumps from a maximum of 8GTps to 16GTps (GTps = Gigatransfer), and it also has massive power reduction benefits that should help portable systems.



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To support this, both Intel and AMD will be launching new chipsets, new processors, and also you'll need new video cards to work with it. But, it will be backwardly compatible with PCIe 3.0, so existing video cards should work well in PCIe 4.0 slots.

I'd moan that things change too often, but PCIe has been around seven years. With that information, those wanting to build the ultimate gaming system might need to wait a little longer, if they want something that exploits these new enhancements.

## Useful To Have Along

When I considered writing this feature I thought about exactly what I'd put in a new PC if I built one today. After much chin scratching, one feature that I really would include is USB type-C, because in about five years I predict it will have taken over USB ports entirely.

You can get it on some motherboards already, but it's something you can also easily add with a card or even with a front-panel header plate.

Not that I would dispense entirely with conventional USB this minute, but this change will be necessary going forward. For this reason, I'd make sure any motherboard you buy has a proper 20-pin USB 3.0 header on it, for the front-panel ports.

## Those We Leave Behind

If you have an ATA drive still, with some converter to SATA or even an IDE card, ditch it now, please! The performance of any IDE drive compared with SATA is utterly abysmal, and they use lots of power to do things slowly too. The same is also true of SATA-1 and SATA-2 hard drives, where the amount of bandwidth is very limited.

For exactly the same reasons, I'd dump any IDE optical drives, and on my latest system, I've actually dumped SATA optical too. I don't use discs often, and when I do, I have a USB 3.0 optical drive for the job. Having hardware hanging around the PC on the off-chance that I'll use it seems ludicrous.

USB 2.0 is also not something that you'd want to encourage in a new system, especially when USB 3.0 is backwardly compatible with its older incarnation. Those with a USB 2.0 card can leave it in their old PC, because a cheap hub on a single USB 3.0 port on their new system would be much more effective.

Examining many systems over the years, I've seen some crazy stuff still on a modern PC, like a modem. What's important to remember is that systems generally work better the less complicated they are. It's also much easier to identify what might be wrong if you do have a problem.

If you're transferring to a new flagship, it's a good time to perhaps leave as much of the legacy junk on that system as you can and truly get a fresh start. Unless you butcher it entirely, you can always fire it up to use that SCSI scanner or whatever, should you ever need that facility again.

## Final Thoughts

The concept of future proofing is one we've explored in numerous articles in Micro Mart, and it comes with a substantial caveat. When you construct a new computer, you've no idea what revolutionary thing someone will come up with next that makes what you've got obsolete. And if the last 40 years of computing guarantees anything, it's that those developments will happen, and they will change everything.

Obsolescence is part of the personal computer ride, and we've all watched things we spent plenty on to be the best be relegated to less than scrap value in short order.

The fine irony is that at some point, probably not that far down the road, the PC as a concept will probably hit the buffers entirely, and the ideas that have been central to it, like the X86 architecture and the Windows operating system, will go to the knacker's yard too. But that's fine, because if it were otherwise, I'd be typing this on Wordstar 1.0 on a CP/M running Z80 based machine.

If a PC can give you five good years use before you even think about moving on, then you've had some decent use out of it, and those that get ten out their hardware, I salute you.

If you have no intention of upgrading your PC ever, then you should really entertain the idea of a laptop, unless you're a gamer. Those who do like to tinker can stick to the desktop form factor, with a decent nod to those changes they're likely to make over its life. Having slots, bays and a case big enough to handle those changes just makes sense. Or it will when you come to make those alterations.

Being realistic, you can never cover all the possible directions that technology will go in, but you can avoid heading down the most obvious cul-de-sacs with a little research. [mm](#)



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# How Much Gaming PC Do You Need For Maximum Detail?

If you want to play games with the highest detail, what kind of PC do you need?

Regardless of the gaming generation, if you've dabbled in PC gaming you'll know that it's a lot more involved than other platforms. Whether you've been a PC gamer since the days of the 486, Pentium, 3DFX, and OpenGL, or you're only versed in more recent tech – such as Nvidia's GeForce, ATI's Radeon, Crossfire, or SLI – you'll know that installing and playing a game is not exactly a plug and play procedure. Before you can take your first steps into any new digital world, you'll need to ensure your PC can handle the task at hand and, depending on any technical issues, you'll need to spend time tinkering with graphics settings to get the best possible performance out of the game.

Now, those who can afford to buy the best possible gaming hardware around will instantly eliminate much the need to look at much of what's to follow. They'll be able to crank up everything to

the highest settings and still enjoy a fluid FPS rate. It will take quite a lot of cash, of course, but for gamers who want the very best experience, it's probably the only way to play.

This breed of PC owner often doesn't just spec their PCs for great gaming, but also out of a sense of pride. It's desirable to build an impressive gaming PC, and it's often a fact to brag about with others. They're a kind of status symbol amongst gamers who care for such things, and graphical benchmark tests aren't only for seeing how well your PC can run the latest software tech, but to also share scores with others in an effort to have the fastest kit. There are even world championships for such things, including overclocking. It's big business, and a lot of people spend a great deal of their time tinkering with a system to make it as fast and powerful as possible.



▲ 16GB RAM doesn't cost too much

For most users, though, simply having a PC that can run the latest games is the only real goal, and having one that can do so at the highest detail level is even more desired. Not having to reduce texture resolution, turn off shadows, disable god-rays, and so on can be a dream for some, but what does that dream entail? What specification of PC do you really need for today's latest games?

## The Test System

In a mission to see just how well various games perform, and to see what level of PC is needed we decided to check a number of popular games that have, or are known to tax gaming PCs. We've dug up their recommended specifications (the specs devs and publishers specify for high-end visuals), and we tested the games on a test system for average FPS. The test system is as follows.

**Intel Core i7 5930K CPU running at 3.5GHz**  
**16GB of RAM**  
**Three GeForce GTX 980 GPUs 4GB with the latest drivers available at the time of testing (375.70)**  
**2TB Hybrid HDD**  
**Direct X 11.1**  
**Windows 10 64-bit**

The system is running a 4K monitor at 3840x2160, as we feel testing for high-end gaming really needs to take in the drag on resources you'll get from a 4K display. Given that SLI cards don't actually stack the VRAM, it's limited to the RAM from a single card.

## The Games

The best way to begin our look at the specification of PC you need is to flesh out exactly what we're trying to quantify here: a system's ability to play the games themselves. The thing is, AAA games change drastically from a technical point of view all the time, and although PCs don't really have 'generations', as consoles do, the power needed to run games does jump up in leaps and bounds, promoting the development and need to purchase more powerful hardware.

There are countless games out there, of course, and to cover them all is impossible here, but the following examples will first tell you the recommended specs of some of the more popular games around right now and then the average FPS we got during our own tests with the above system. These are games that have been known to really push PC hardware, and need a powerful PC in order to run at full graphical settings.



▲ Battlefield 1

For the most part, these are either first or third person perspective games – genres that tend to be the most graphically advanced. There are still some fairly taxing RTS and adventure titles around too, though. Simulators can be heavy on specifications at times as well.

## Battlefield 1

<b>CPU</b>	Core i7 3.6GHz/FX-8360
<b>GPU</b>	6GB GPU (GTX 1060/Radeon 480)
<b>RAM</b>	16GB
<b>HDD</b>	50GB
<b>OS</b>	Windows 10
<b>DirectX</b>	11.1

## Average FPS during tests - 75

*Battlefield 1* is huge right now, and also one of the most demanding games in terms of hardware. As a large-scale multiplayer FPS, it demands a lot of visual muscle, processing, and RAM. Visually, the card you'll need to get the best benchmarks will be something akin to the GTX 1060 or Radeon 480. You'll need around 6GB of VRAM, or more if possible. As with many games released today, Windows 10 is the optimum OS, with DirectX 11.1 being ideal (the game will run with 11, though).

Despite being the newest game here, *Battlefield 1* actually got a consistently high average FPS of around 70-75 during tests with our system. This is a testament to the game engine and how optimised it is. This means that you may need higher specs than some games on paper, but even with a less powerful PC, you'll likely get better results than some games that are a few years older.



▲ Radeon 480



▲ *Crysis 3*

### Star Wars: Battlefront

<b>CPU</b>	Core i5 3.3GHz/FX-8370
<b>GPU</b>	4GB (GTX 970/R9 290)
<b>RAM</b>	16GB
<b>HDD</b>	40GB
<b>OS</b>	Windows 10
<b>DirectX</b>	11.1

#### Average FPS during tests: 50

Very similar to *Battlefield 1* (no surprise as it's from the same developer), *Star Wars Battlefront* has similar hardware demands. However, while still visually stunning, the game needs less VRAM (4GB), and a lower-end CPU can still run it at max detail.

This comes with a drop in average FPS, though, which we found evened out at around 50. This is despite the game being older and having lower recommended specifications. Our system couldn't top the FPS managed in *Battlefield 1*. Clearly, the newer games has a far more optimised engine.

### Crysis / Crysis 3

<b>CPU</b>	Core 2 Duo 2.2GHz/Athlon 62 X2/Core i7 3.4GHz/FX-4150
<b>GPU</b>	400MB Geforce 8800 or Radeon HD 3850 / 2GB Geforce GTX 680 or Radeon HD 7970
<b>RAM</b>	2GB / 8GB
<b>HDD</b>	12GB / 20GB
<b>OS</b>	Windows XP / Windows 7
<b>DirectX</b>	9 / 11

#### Average FPS during tests: 60 / 30

We felt we had to include Crytek's seminal FPS, not least because the first game in the series coined its own PC specification-related phrase: "Will it run *Crysis*?"

We've opted for the first and third game to not only show the difference in recommended spec over the years, but also to show how games in the same series can really change up the end result. As you can see, thanks to having a lower recommended specification, the original *Crysis* fares much better than the newer *Crysis 3*. Unlike *Battlefield 1* and *Star Wars Battlefront*, the older game massively outstrips its sequel in terms of performance, hitting a regular average FPS of around 60, whilst the third game plodded along at 30.

Still, despite being nine years old, the original *Crysis* still runs worse than *Battlefield 1* on our test rig. That may seem crazy but shows how the use of 4K takes its toll, an effect that's possibly made worse as the game really wasn't written for such displays.

### The Witcher 3: Wild Hunt

<b>CPU</b>	Core i7 3.4GHz / FX-8350
<b>GPU</b>	2GB Geforce GTX 770 / Radeon R9 290
<b>RAM</b>	8GB
<b>HDD</b>	40GB
<b>OS</b>	Windows 7
<b>DirectX</b>	11

#### Average FPS during tests: 30

It's really not surprising that *The Witcher 3* was such a strain, especially at 4K. The fantastic open world RPG has such impressive visuals for this kind of game, it's one of the few that really makes you understand just how much is going on behind the scenes. Its game world is so detailed, with so much going on, right down to moving branches and leaves, the PC has to work very hard indeed. At such high resolutions and detail, your PC will be getting a major workout.

Having an average FPS of 30 may not sound pleasing to a lot of PC gamers, who can often tweak settings to achieve much higher FPS rates and thus get much smoother gameplay. With *Witcher 3*, however, it's a very acceptable rating. Which leaves us to enjoy one of the most visually impressive, and taxing, games around.

### Just Cause 3

<b>CPU</b>	Core i7 3.4GHz / FX-8350
<b>GPU</b>	3GB Geforce GTX 780 / Radeon R9 290
<b>RAM</b>	8GB
<b>HDD</b>	54GB
<b>OS</b>	Windows 7
<b>DirectX</b>	11

#### Average FPS during tests – 25

A game notorious for long loading times and an engine plagued with performance issues, *Just Cause 3* is also a very good-looking title. It's another open world game, and as such there's a lot going on at any one time, both graphically and otherwise. Because of this, and an engine that's just not as well optimised as others, it's a title that'll really push your machine, even if not out of design.

We only managed to get around 25fps on average playing this game, which isn't great given the games that perform better that are more visually detailed and more recent. Still, *Just Cause 3* is a very pleasing game to look at, and it has a lot of work going into the impressive physics engine, so there's a little more reason here for a lack of overall performance.



▲ *The Witcher 3*





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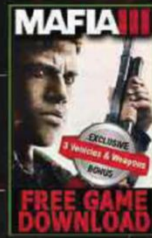
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▲ *Just cause 3*

### **Batman: Arkham Knight**

**CPU** Core i7 3.4Ghz / F-8350  
**GPU** 4GB Geforce GTX 980 / Radeon R9 290X  
**RAM** 8GB  
**HDD** 55GB  
**OS** Windows 8  
**DirectX** 11

**Average FPS during tests: 15-20**

With all of the controversy upon release of the PC version of *Arkham Knight*, it really didn't come as much of a shock that this would be one of the worst performers in our tests. The steep recommended specs give away a game that obviously needed a little more time in optimisation, and running it at 4K, even with a triple SLI setup, didn't exactly generate impressive results.

An average FPS of 15-20 for a spec like the one we had in our test setup just isn't good, and thanks to the numerous reports of many, many gamers online, the recommended specifications fared even worse at times, even when not running in 4K. It just goes to show that having a powerful PC that's cost a lot of money doesn't necessarily mean you'll get guaranteed performance, especially if a game has had a shoddy development. That's PC gaming in a nutshell.

### **Rise of the Tomb Raider**

**CPU** Core i5 2.4Ghz / FX-6120  
**GPU** 4GB Geforce GTX 970 / Radeon R9 390  
**RAM** 6GB  
**HDD** 25GB  
**OS** Windows 7  
**DirectX** 11

**Average FPS during tests: 20**

Although this is a new release for PS4 owners, *Rise Of The Tomb Raider* has been around longer for PC players (and Xbox One, of course), so the specs aren't as recent as other games around at the moment. Still, they're quite high still, and the game is a real looker. The 'open-world lite' approach the game takes is a little more demanding than some more linear games, a factor that was certainly demonstrated when playing it using our test machine, which spluttered along producing an average FPS of only around 20.

Like *Batman*, this isn't a great score at all, and although *Rise Of The Tomb Raider* seems to be a much more optimised graphic engine, it doesn't run all that well at 4K, even on quite a meaty PC. True, our test system isn't the most powerful in the world, far from it, but it's still quite a beast when compared to a lot of PCs out there, and we'd expect more fluid results out of the game, if we're honest.



▲ *Batman Arkham Knight*



▲ *Rise Of The Tomb Raider*



▲ *ARK: Survival Evolved*

## ARK: Survival Evolved

**CPU** Core i5 3.2Ghz / FX-8350  
**GPU** 2GB Geforce GTX 660 / Radeon HD 7870  
**RAM** 8GB  
**HDD** 20GB  
**OS** Windows 8  
**DirectX** 11

**Average FPS during tests - 5-10**

*ARK: Survival Evolved* has become one of the most popular of the waves of survival titles flooding the market. Rather than task you with fighting against undead in a typical zombie apocalypse scenario, Ark puts on a strange island populated by prehistoric creatures. You have to defend yourself from these threats, as well as other players, all the time scavenging for resources to build shelter and new technologies.

As with all of these online, open-world survival games, Ark is a potentially stressful proposition on any system, as there's going to be a lot to handle alongside the online requirement. Often, these games are visually stunted in order to make things manageable, but Ark has impressive graphics, and this certainly showed in our tests, which produced very low average FPS scores.

## GTA V

**CPU** Core i5 3.2Ghz / FX-8350  
**GPU** 2GB Geforce GTX 660 / Radeon HD 7870  
**RAM** 8GB  
**HDD** 65GB  
**OS** Windows 8  
**DirectX** 11

**Average FPS during tests - 5-10**

As arguably the most popular game of the last couple of years, and a title that's still in the charts today, Grand Theft Auto 5 is a huge success, and for good reason. However, when it comes to running on our 4K test setup it was a different story.

GTA V actually managed to get the lowest FPS score by a small margin between it and Ark, which is very surprising given the pedigree behind it, and the far superior scores of games that are far more demanding in terms of specifications. This is even more surprising given that GTA V is essentially a console port, meaning the intended hardware is less powerful than the even the standard recommended PC.

Clearly, the level of optimisation behind the scenes just isn't up to par, and it shows, with very poor FPS on a machine that should easily be hitting much higher, even at 4K.

## Analysis

So, we've put a few popular games through their paces on a test system that's more than capable of running them. We did have the added pressure of 4K, sure, but we're looking at the best system you may wish to buy here, and 4K is the current major goal for gamers, so this makes sense. Obviously, the results would differ when running on a lower resolution.

Combine this with the recommended specifications we've listed, and we have a good picture of the kind of hardware you're going to need if you want to run games at the highest detail and resolutions.

On average, if we eliminate the 4K issue, it's safe to say that a good general specification for running most games at the highest details would include at least a 3GHz CPU and at least 8GB of RAM. For the GPU, you should be looking at a 4-6GB model, preferably one that's in the last couple of generations. For Nvidia you'll want to go with the higher mid-range to high-end, that's sticking with the GTX range. For Radeon models, you're looking for the R9 cards.

For system RAM we'd say the more the better is often the case, but at least 8GB will be good for most, and 16GB is a good target to go for as it should cover you all situations.

In terms of OS and other concerns, it's really down to individual specification of software. You'll need plenty of hard disk storage, and your OS should be at least Windows 7, with the ideal being Windows 10 for compatibility's sake.

Going back to the 4K performance, it's clear that this has a very big impact on overall performance, and this is one of the reasons we decided to implement this into our testing. It illustrates brilliantly how making the move to 4K means much more than simply buying a new monitor and/or GPU. There's much more going on behind the scenes, and if you plan to move on to 4K gaming, you'll need to be aware of the requirements and potential problems.

It also underscores an often ignored element of user questions regarding performance and requirements, and that's the individual performance of the games themselves. As you can see, even with a monster gaming system, some titles perform much better than others, so no matter how much money you spend, you could still end up with a poor level of performance. Again, our test system without the 4K strain would run most games with no issues, but for the full, state of the art HD experience, there's currently a high ceiling in terms of requirements.

## Costing

How much does this kind of setup cost? The actual outlay will vary wildly, and depend on many things, but for the core makeup of any gaming system, we can provide a rough estimate of a decent, high-end machine. For this, we'll focus on the main components – the CPU, GPU, RAM, and hard disk.



▲ *Grand Theft Auto V*

Let's begin with the CPU: for around £280 you should be able to snag a good Intel Core i7 3.6GHz that can handle just about anything you throw at it with ease. AMD users can also grab a great model in the FX-8360 for around £150, a big saving on the Intel option. For the GPU, a 6GB Nvidia GTX 1060 will set you back around £250, whilst a Radeon 480 costs slightly less, at around £230. RAM is a lot more flexible, and there's a tonne of it around for decent prices. We found many different 16GB DDR4 packs costing in the area of £100 – and DDR3 for less, at around £60-70. As for storage, a 2TB hard disk shouldn't cost much more than £60-70. All-in, then, you can expect to pay in the neighbourhood of £700 for those components.

As with the CPU, your choice of motherboard will be a big decision, and to some degree this will also effect your overall performance. You'll need to choose a one with room for expansion, and to handle your choice of GPU, be that single or multiple. As you're looking at a high-end model, don't concern yourself with on-board video, as you'll not be using it. Instead, focus on decent audio if you don't want a discrete audio card, and make sure there are plenty of connections for external devices and video outputs.

A great example for Intel users is the excellent ASUS Z170 Pro Gaming model. This costs around £150 and has been praised by critics for it's great performance. We've certainly found it to be a very solid model, and one that should carry your high-end kit easily. AMD users could go for Gigabyte's GA-990FXA-UD7. For around £140, it's a very capable gaming board that boasts a great layout that can house the high-end hardware you'll be slotting onto it.

That puts the guts of the system at around £850, which in the grand scheme of things isn't a huge price to pay, certainly not in the realm of the thousands some users pay. Of course, your choice of case, monitor, and so on will increase this, but picking the best monitor is a whole different kettle of fish. Hopefully, this overview gives you a good idea of the hardware you'll need and highlights the effects different games and their development can have on your end-user experience. [mm](#)



▲ *Nvidia GTX 1060*



▲ *ASUS Z170 Pro*

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## David Briddock marks the ISS Proxima Mission with Astro Pi coding hints, tips and examples

In issue 1419 we covered the Astro Pi project ([astro-pi.org](http://astro-pi.org)) which sent two Raspberry Pi based scientific modules to the International Space Station (ISS).

Affectionately named Ed and Izzy these Pi modules were used by British astronaut Tim Peake to perform scientific experiments during his six-month ISS mission. Look inside the custom-made space-ruggedised flight cases and you'll see each module is a Raspberry Pi 2 plus a camera and a multi-sensor SenseHAT.

A key part of the mission was an open competition to schools across the UK to design and code software programs. The winning entries were uploaded to the ISS then installed and run on Ed and Izzy.

### Proxima Mission

In November a Soyuz rocket launch from Baikonur cosmodrome in Kazakhstan marked the start of another six-month-long ISS mission called Proxima.

As you probably know, Ed and Izzy are still aboard the ISS and there are plans to put them to use running new scientific

programs. This time they'll be under the guidance of ESA French astronaut Thomas Pesquet ([goo.gl/vyT8cq](http://goo.gl/vyT8cq)).

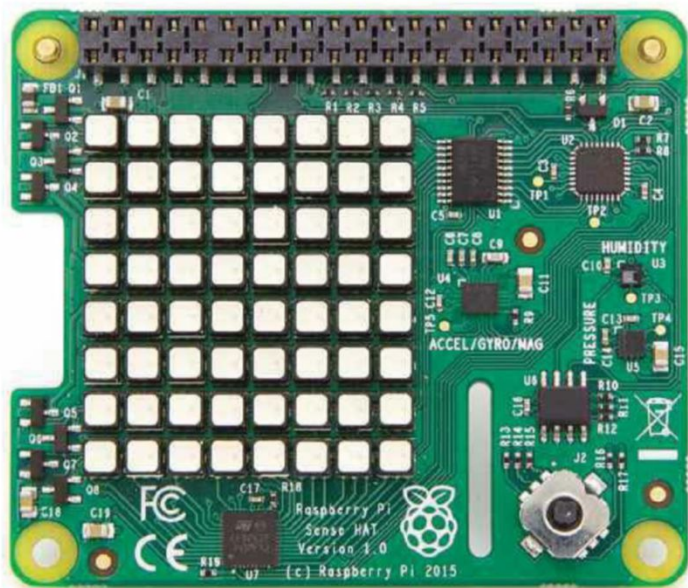
Understandably the Raspberry Pi Foundation was delighted to hear about the second mission, especially after all the hard work involved in putting the two Pi units through the rigorous Flight Safety Certificate (FSC) testing process.

As part of the ISS Proxima Mission there's a brand new Astro Pi School Challenge competition for schools. Once again they've been asked to design and code novel and interesting programs suitable for the Astro Pi modules. However, this time UK schools will be joined by ones from France, Spain, Germany and other European countries. Once again the winning programs will be installed and run on Ed and Izzy.

Before returning to Earth astronaut Tim Peake plugged in an Ethernet cable to the Astro Pi devices. This small action makes a big difference as there's now direct space-to-ground communications with Ed and Izzy. This means that the Proxima Mission team is going to find it much easier to upload Pi software to the ISS and download the experiment data back to the ESA mission control centre.

To find out more about this ISS mission, take a look at the new Mission Plan Template by navigating your web browser to [magpi.cc/2enYSWP](http://magpi.cc/2enYSWP).





▲ SenseHAT

## SenseHAT

A Raspberry Pi and a SenseHAT is all you need to code and run the sort of programs that operate aboard the ISS. This code could be created from scratch from an idea you've already had buzzing around. Alternatively you could start with an idea from a magazine or website, then add your own bespoke features and functionality.

## “ A Raspberry Pi and a SenseHAT is all you need to code and run the sort of programs that operate aboard the ISS ”

Whichever option you choose this week we'll show you a number of Astro Pi centric Python version 3 coding tips and tricks. To get started boot up your Raspberry Pi, then fire up the IDLE development tool by going to the 'Programming' section of the main menu and selecting the 'Python 3 (IDLE)' option.

The first task is to ensure we have at our disposal all the Python functionality provided by the SenseHAT library module. In Python all we need to do is import this library module and create a 'sense' object with these two lines of code:

```
from sense_hat import SenseHat
sense = SenseHat()
```

Now we're able to call any of the methods on the 'sense' object. For example, we can display a character and a message on the 8x8 square LED display like this:

```
sense.show_letter("X")
sense.show_message("Hello")
```

Pretty straightforward stuff, but we can go much further. For example, setting text and background colours, the message scroll

speed and rotation angles. And by controlling each individual pixel you can create multi-coloured 8x8 pixel images.

Now let's look at accessing environmental sensor readings. Here's a code example to obtain the current temperature, pressure and humidity:

```
t = sense.get_temperature()
p = sense.get_pressure()
h = sense.get_humidity()
```

By the way, the normal environmental operating conditions for the ISS are a temperature range of 18.3C and 26.7C, a pressure range of 979 millibars to 1027 millibars and around 60% humidity.

Ascertaining the Pi's position in three-dimensional space in terms of pitch, roll and yaw is also pretty simple. Here's an example:

```
orient = sense.get_orientation()
pitch = orient['pitch']
roll = orient['roll']
yaw = orient['yaw']
```

In a similar way we can obtain the accelerometer values, which indicate how fast or slow the Pi is moving. Here's an example:

```
accel = sense.get_accelerometer_raw()
x = acceleration['x']
y = acceleration['y']
z = acceleration['z']
```

## SenseHAT Emulator

But what if you don't have a Raspberry Pi and SenseHAT to hand? Well, it's still possible to play along as all you need is a web browser. With Trinket's SenseHAT simulation website ([trinket.io/sense-hat](http://trinket.io/sense-hat)) you enter Python code and see the results via an animated image.

The web page is split into two sections. Code is entered on the left and the SenseHAT image appears on the right. While not the most ergonomic web app design I've seen, there's a 'Run' and 'Stop' menu to try out your code, Python module documentation plus a number of code sharing options.

Initially the code editor half contains an LED display example code listing. But towards the bottom of the page you'll find a sensor data code example plus a number of games. A simple 'click' replaces the contents of the editor with the code for the selected example.



▲ Astro Pi

```

1 import os, csv, datetime
2
3 # define column numbers
4 COL_HUMIDITY = 4
5 COL_PRESSURE = 5
6 COL_TIMESTAMP = 19
7
8 # load the CSV data into a list of rows and columns
9 # extract column names from first row then remove
10 def load_csv(filename):
11     with open(filename, "r") as f:
12         reader = csv.reader(f, delimiter=",")
13         lst = list(reader)
14         hdr = lst[0] # capture column names
15         lst.pop(0) # remove first row
16         return hdr, lst
17
18 # get data, extract column names then remove first row
19 colNames, rows = load_csv(os.getcwd() + "/Columbus-Ed.csv")
20 print(colNames)
21
22 # process each row
23 for num in range(0,100):
24     row = rows[num]
25     hum = float(row[COL_HUMIDITY])
26     dt = datetime.datetime.strptime(row[COL_TIMESTAMP], '%Y-%m-%d %H:%M:%S')
27     print('Humidity: %.2f At: %s' % (hum, dt))

```

#### ▲ CSV code example

Most importantly, the code you write is identical to what you'd use on a Raspberry Pi equipped with a SenseHAT. This means your tested code can simply be copied to a real Pi with SenseHAT. This is a boon for classroom situations where there's not enough Pi hardware to go around. And ideal for students wanting to try out code, either as homework or just for fun.

The website is the ideal way to experiment with LED interaction code. And there are sliders to change the temperature, pressure and humidity values. But when it comes to things like motion sensing using the online emulation just isn't the same thing as playing around with a real Pi with attached SenseHAT.

Trinket also offer a Pi-hosted emulator app, which is already included in the latest Raspbian Jessie release. Alternatively use the download instructions ([goo.gl/9T5Sjd](http://goo.gl/9T5Sjd)) which cover Raspbian, the Ubuntu operating system and the Python 'pip' utility.

Once installed on a Raspberry Pi the emulator app is accessed from the Desktop menu under 'Programming'. You can write your code in the Python IDLE editor just as before. All you need to do is subtly change the import statement replacing 'sense\_hat' with 'sense\_emu', like this:

```
from sense_emu import SenseHat
```

After this change any SenseHAT code example should work fine. Just change it back to use 'sense\_hat' when you run the code with a real SenseHAT.

## Online Resources

The SenseHAT has been around for quite a while now. Consequently there's a healthy collection of online documentation and code examples. While there are too many websites to list here it is worth mentioning a couple of highlights.

Parents and teachers will find plenty of useful information on the official Raspberry Pi education resource pages. Here you'll also find a 'getting started' tutorial based around the Trinket web-based emulator ([goo.gl/kCDV6m](http://goo.gl/kCDV6m)).

One particularly useful Python coding resource is the SenseHAT application programming interface (API) reference pages ([pythonhosted.org/sense-hat/api](http://pythonhosted.org/sense-hat/api)). It covers the LED Matrix, all three environmental sensors (temperature/pressure/humidity), the inertial measurement unit (IMU) sensor and the built-in joystick.

For those playing with the emulator app the 'sense-emu' documentation pages provide a detailed picture of the functionality on offer, along with numerous code examples ([sense-emu.readthedocs.io](http://sense-emu.readthedocs.io)).

## Science Data

Ed and Izzy have also been put to work acquiring scientific data. The data was collected via the various SenseHAT sensors with a special 'flight recorder' program that ran 24 hours a day over a number of weeks.

This 'flight recorder' experiment generated three large CSV data files (see boxout) filled with Astro Pi sensor data. These files have been downloaded back to Earth and uploaded to the online GitHub repository in the form of compressed zip files ([goo.gl/cSUY9d](http://goo.gl/cSUY9d)).

Two of these CSV zip files contain data collected by Ed in the ISS Columbus module. The first 'Columbus\_Ed\_astro\_pi\_datalog.csv.zip' file has two weeks worth of data, while the second 'Columbus2\_Ed\_astro\_pi\_datalog.csv.zip' contains data captured over four weeks.

Izzy collected data from the ISS Node 2 location over a two-week period and her data is contained in the 'Node2\_Izzy\_astro\_pi\_datalog.csv.zip' file. In the same GitHub location you'll also find an example CSV file, which contains test data recorded before the launch.

“ With a Raspberry Pi, we have access to the very same Astro Pi technology that's installed on board the ISS ”

Download and unzipped these files and you'll soon discover they are crammed full of sensor data; even the smallest has over 100,000 rows across 20 data columns (see boxout). The high volumes are due to frequent sensor readings, sometimes as often as every 10 seconds.

This poses quite a challenge when it comes to identifying regular patterns or picking out strange anomalies. However, with a little Python code we can access specific columns and particular time periods.

## Python 3 Example

Here's how to get started using Python 3. First we'll need to import a few library modules:

```
import os, csv, datetime
```

### CSV Files

CSV stands for 'comma-separated values'. While the format has been around for decades it's still a useful way to store tables of information as plain text. And CSVs are supported by spreadsheet-style apps like Microsoft Excel, LibreOffice Calc, OpenOffice Calc, Google Sheets, Lotus 1-2-3 and many more.

Most coding languages are able to open and read CSV files. This includes the Python language installed on a Raspberry Pi or on a PC running Windows, macOS or Linux.



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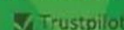
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▲ Ed and Izzy

With these imports in place we can now open one of these CSV files and extract the data with just a few lines of code. If we put this code into a function we can call it again and again:

```
def load_csv(filename):
    with open(filename, "r") as f:
        r = csv.reader(f, delimiter=",")
        return list(r)
```

This function returns the data as a Python list. If the unzipped CSV files are renamed to 'Columbus-Ed1.csv', 'Columbus-Ed2.csv' and 'Node2-Izzy.csv', we can open a file in the current working directory like this:

```
f = os.getcwd() + "/Columbus-Ed1.csv"
rows = load_csv(f)
```

The 'rows' variable now contains a Python two-dimensional list object containing the CSV data columns and rows. In effect, it's very similar to the representation you'd see in a spreadsheet, where each cell can be addressed by its column and row number.

The first row is a little different as it contains the column names rather than data. We can extract these names into a variable, then remove this row like this:

```
colNames = rows[0]
rows.pop(0)
```

Now the 'rows' list contains pure sensor data. To extract data for a specific sensor we'll need to specify a column number. Note the column numbers actually start from zero.

Here's a loop that extract the first 1,000 rows of humidity data, converting the text value into a floating point number and printing out this number each time we iterate round the loop:

```
COL_HUMIDITY = 4
for i in range(0,1000):
    row = rows[i]
    hum = float(row[COL_HUMIDITY])
    print('Humidity: %.2f' % (hum))
```

For full data analysis we'll need the date and time of the readings, contained in column number 19. To be useful we'll need to convert the text value into a native Python 'datetime' object. This code can then be added to the row processing loop, as shown in CSV code listing.

Now take these basic coding principles and build an app of your own that uses some or all of the CSV file data. There are really no limits to what's possible, so just let your imagination flow.

If you need some inspiration take a look at Hannah Belshaw's SpaceCRAFT, one of the winning entries from the Tim Peake mission

competition, which displays CSV-sourced data in the Minecraft game ([astro-pi.org/competition/winners/#spacecraft](http://astro-pi.org/competition/winners/#spacecraft)).

To find details of all the school competition winning entries associated with Tim Peake's Astro Pi mission go to the [astro-pi.org/competition/winners](http://astro-pi.org/competition/winners) webpage.

## Wrap Up

Unfortunately, we can't all be astronauts. But, we can take an active part in space missions. With a Raspberry Pi we have access to the very same Astro Pi technology that's installed on board the ISS, then create our own 'space' programs.

That's amazing thing to be able to say. And the Raspberry Pi Foundation is justifiably proud to have achieved such a feat with such an affordable product. [mm](#)

## CSV Data Columns

The downloadable Astro Pi Science Data CSV files many columns including Astro Pi temperature, ambient temperature, relative humidity, air pressure, 3D orientation, 3D acceleration, 3D magnetic field strength and 3D rotation. Thankfully they all have meaningful names. Here's the full list:

- row\_id:** Unique row identity number for each row.
- temp\_cpu:** Raspberry Pi CPU temperature degrees in Celsius.
- temp\_h:** Ambient temperature in degrees in Celsius (Sense HAT humidity sensor).
- temp\_p:** Ambient temperature in degrees in Celsius (Sense HAT pressure sensor).
- humidity:** The percent relative humidity (Sense HAT humidity sensor).
- pressure:** Air pressure in millibars (Sense HAT pressure sensor).
- pitch:** Pitch orientation angle from 0 to 360 degrees (combined Sense HAT accel, gyro and mag readings).
- roll:** Roll orientation angle from 0 to 360 degrees (combined Sense HAT accel, gyro and mag readings).
- yaw:** Yaw orientation angle from 0 to 360 degrees (combined Sense HAT accel, gyro and mag readings).
- mag\_x:** X axis magnetic field strength in micro-teslas (Sense HAT magnetometer).
- mag\_y:** Y axis magnetic field strength in micro-teslas (Sense HAT magnetometer).
- mag\_z:** Z axis magnetic field strength in micro-teslas (Sense HAT magnetometer).
- accel\_x:** The acceleration intensity of the X axis in Gs (Sense HAT accelerometer).
- accel\_y:** The acceleration intensity of the Y axis in Gs (Sense HAT accelerometer).
- accel\_z:** The acceleration intensity of the Z axis in Gs (Sense HAT accelerometer).
- gyro\_x:** X axis rotational intensity in radians per second (Sense HAT gyroscope).
- gyro\_y:** Y axis rotational intensity in radians per second (Sense HAT gyroscope).
- gyro\_z:** Z axis rotational intensity in radians per second (Sense HAT gyroscope).
- reset:** Copy of the Raspberry Pi CPU reset register.
- time\_stamp:** Date and time of data readings (Astro Pi real-time clock).



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# PHILIPS

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CHERRY



## CHERRY MX Board 3.0

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£64.00

The CHERRY MX Board 3.0 offers a perfect introduction to mechanical keyboards, utilising Red, Linear MX switches under each key. The keyboard design is low profile and simplistic, yet robust and hard wearing, with laser-etched, wear-resistant keycaps and individual keys tested to 50 million operations. 14 key rollover, Win-Key Lock and anti-ghosting technology, coupled with a removable USB cable make this an ideal gaming keyboard, but it's perfect for both home and office use.

CHERRY

## CHERRY DW 5100 Board

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Break free from wires! The CHERRY DW-5100 is a stylish and comfortable keyboard and mouse set, using 24GHz technology for an interference free, 5m range. The mouse has a switchable 1000/1750-dpi resolution for fast desktop movement, 5 programmable buttons and a rubber side-grip for added comfort. This ergonomically designed mouse also has batteries that will last for up to 2 years between changes. The keyboard is a low-profile design with 10 programmable hot keys and an on/off switch to help conserve power. Supplied with a nanoUSB receiver, the set is simply plug and play with no additional software required.

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## Promotional feature

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The mydlink™ Home smartphone and tablet app is the command centre for the D-Link range of smart home technology devices. There's no better time of year to discover mydlink Home – smart technology working together for a safer, more interactive home.

\*November price list This clever little starter kit lets you set, control, monitor and automate your home from anywhere.



**D-Link**

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[www.amazon.co.uk](http://www.amazon.co.uk)  
£142.00

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# **G Suite**

## Smart Apps and Services

**David Briddock explains why Google  
is introducing machine learning  
technology into the world**

**G**oogle is determined to be seen as a serious competitor to Amazon, Microsoft and others in the cloud computing arena. Recently, we've seen the introduction of the Google Cloud, which encompasses the Google Cloud Platform, and now we have something called G Suite.

G Suite appears to be a key element in Google's cloud-centric mission. The idea is to create a tightly integrated package of productivity apps and services that appeal to individuals, freelancers, and the self-employed, as well as large-scale international companies.

So, what exactly is G Suite, and what does it offer to you and me, and the way we work?

### **What's Included**

G Suite aims to become the essential core of someone's daily computing activities. Activities like personal productivity and organisation, group communications, social networking, and digital resource management.

G Suite's productivity tools compete directly with Microsoft's Office 365 and include the now well-established Docs, Sheets, Forms, and Slides. While Gmail, Calendar, Hangouts and Google+ handle the scheduling of both personal or work-related interactions. Behind all of these is Google Drive, which is there to ensure everything you create is stored securely in the cloud, ready to be accessed from a range of devices. Indeed, all



these apps and services are designed to operate in a reasonably seamless manner across smartphones, tablets, laptops, and desktops. Some of them are even applicable to Google Android, or Apple watchOS, smartwatches.

Having read that, however, you might be thinking G Suite doesn't seem to be offering anything particularly new. After all, this selection of cloud-centric apps was previously included in Google for Work, or even earlier with Google Apps. So, you might be asking: 'why has Google re-launched all this under a new brand name?'

### Added Intelligence

Well, Google is claiming that it is enhancing the usefulness these apps and services by incorporating machine learning intelligence. What this means in practice, according to the firm, is we'll now be freed from some of those repetitive, mechanical tasks that can take up so much time.

## “ G Suite aims to battle head to head with products like Microsoft's Office 365 ”

Of course, machine learning is a big thing at Google. Over the years it has analysed its colossal cache of user-captured data to determine the features and tasks we use most frequently and the sort of results we are after.

It must be said that this isn't a completely new idea for Google. Gmail has offered auto-generated replies through something called 'Smart Reply' for quite a while now. While not exactly groundbreaking innovation, it still has plenty of supporters. In particular, it's a feature that's been a big hit with smartphone Gmail users wanting to send off a quick response with the minimum of effort. In fact, Google claims well over 10% of all Gmail replies from mobile devices are now sent using the Smart Reply feature.

There's much more intelligence embedded in the G Suite app and service lineup, though. Here's a guide to what's on offer.

### Smarter Drive

To date, Google Drive has been installed on over one billion smartphones. It's become one of the first G Suite products to get the 'be smarter' makeover. Since the end of September, it had a Quick Access capability, which is designed ensure the files you'll need are right at your fingertips as soon as Drive is opened.

Quick Access works by analysing your Drive activity, shared file interactions and things like recurring meetings. For example, if you're in the middle of a collaborative project the relevant files will be immediately available. Google says its customer research indicates Quick Access means you'll find the files you need up to 50% faster on average.

There's a new addition to the G Suite lineup to assist those working in dynamic team environments. Called Team Drive, it is designed to enable fast collaborative file sharing. VP of engineering for Google Apps Prabhakar Raghavan said the facility aims "to get away from the notion that content is owned by individuals."

With Team Drive ownership, sharing rights and roles are all managed at the team level. This helps in two key ways. New team members instantly have access to every project file, and if someone leaves all their work is still available for the benefit of other team members.

### Intelligent Scheduling

With G Suite, the Google Calendar app now comes with smart scheduling. Once again this feature is designed to simplify and speed up the calendar booking process. For example, you can ask the app to 'find a time' for a meeting between yourself and an invitee list. The returned suggestions take into account rooms based on your previous bookings. If there's no obvious free slot Calendar automatically suggests times where the conflicts are easiest to resolve, such as one-to-one meetings.

### Hangouts

Google has improved Hangouts in a number of ways. For example, by applying machine intelligence to the new G Suite version we should be able to make arrangements more quickly and at times that suit everyone involved.

### Being Serious

Up to now Google hasn't been seen as one of the leading players in the cloud services area. All those years of offering beta-level apps certainly hasn't helped. Neither did the well-publicised 15-hour Google Cloud outage at the end of September.

But things are changing quickly. Lead by Diane Greene, founder and former CEO of VMware, Google's cloud strategy Google is acting far more seriously. And it's not just about new initiatives.

Google is also hiring 1,000 new members for its Cloud Customer Team and creating a new Customer Reliability Engineering division. There'll also be a collection of official certifications for cloud architects and data engineers.

Google already has big partnerships like Airbus who, rather appropriately, already use the Google Cloud to identify atmospheric clouds in aerial images. And it will expand its partner ecosystem by adding Accenture.

There are new products too, such as BigQuery for Enterprise which supports standard data warehouse SQL queries and flexible pricing models; allowing Google to boast it is both easier and cheaper than rival products.



▲ **Google Apps**

Firstly, it's hopefully going to be a fair bit easier to set up Hangout meetings. When an event is created, both a short web link and a dial-in phone number are generated. In this way you can invite anyone who has access to a telephone, even if they don't have a computer or smartphone with them at the time.

Other features include seamless integration into Calendar and instant screen sharing. While the updated user interface is said to handle up to 50 video participants; although it's unlikely many Hangout users will want to go quite that far.

**Explore Assistance**

When it comes everyday productivity apps, Google is adding a behind-the-scenes work assistant called 'Explore' to Docs, Sheets, and Slides. Here's how it applies to each app.

In the case of Docs, it acts as a research assistant. For example, it can find references related to specific positions in a document without resorting to the search option. Explore can

“ **Google is adding a behind-the-scenes work assistant called Explore to Docs, Sheets and Slides** ”

use machine intelligence to automatically recommend related topics, additional content and associated images. It will also locate related Google Drive documents.

The spreadsheet Sheets app can now offer users a Natural Language Processing interface. This means spoken, data-related questions can be transformed into a formula within the app. For example you might ask, "What's the average weekly income minus expenses?" and the spreadsheet will calculate things automatically. If it works as promised, it will surely prove useful for those who use Sheets infrequently; to do their end-of-year accounts, for example.

Turning to slides, Explore machine intelligence can be used to dynamically generate design suggestions. If you like what's suggested it's applied with a single click. Google claims it saves 30% of slide creation time for most users by removing the need for manual cropping, resizing or reformatting.

**Pricing**

Although many of its apps and services are freely available, the G Suite package itself isn't free. However, you can try out G Suite for nothing thanks to a 30-day trial. Of course, being cloud-based, there's nothing to download – and you don't have to submit any credit card details. After this time you can choose from two low-cost monthly packages. Designed to be attractive to freelancers, the self-employed, and small businesses the pricing pattern is very similar to its Google for Work forebear.

The cheapest option is the £3.30 per user per month package. For this, you get a single-user 'yourname@yourcompany.com' email address plus any number of group email aliases, such as 'info@yourcompany.com'.

You'll also get video and voice calls, integrated online calendars, 30 GB of online storage for file syncing and sharing, security and admin controls, 24/7 phone and email support, plus tools to quickly build project sites.

The £6.60 per user per month package may be more attractive to larger businesses with extras like unlimited Drive storage (or 1TB per user if fewer than 5 users), advanced admin controls, audit and reporting insights, Google Vault for eDiscovery and email archives.

Billing is done on a monthly basis, and both plans allow users to be added and deleted at any time.

**The Big Battle**

Cloud computing is currently one the biggest growth areas in the IT industry. Gartner research predictions suggest that cloud technology adoption will attract around \$1 trillion of global spending over the next five years. Yet recent surveys show Google is losing the Cloud services battle, trailing some distance behind the Amazon Web Services, Microsoft Azure and IBM's Infrastructure-as-a-Service offering. In fact, Amazon Web Services generated a very healthy \$10 billion-plus in revenues all by itself.

Now the fight would appear to be on, though, and Google isn't a company that's afraid to stump up hefty sums of cash to turn the tables in its favour. It has invested heavily on infrastructure, for example, to the tune of around \$10 billion last year alone. To put that into context, it's almost as much as Amazon and Microsoft spent when added together.

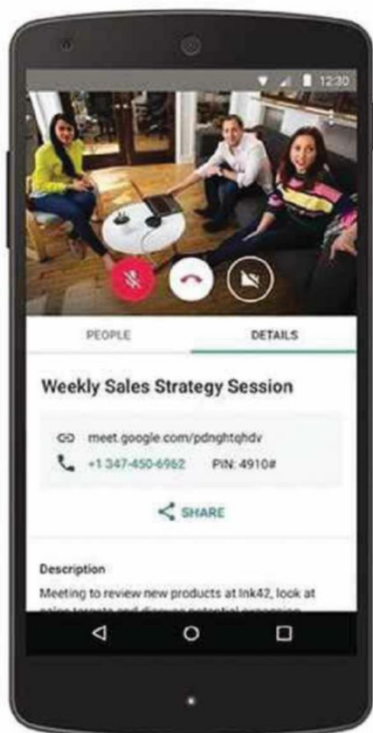
**Data Is The Key**

G Suite's machine intelligence is built on top of sophisticated machine learning algorithms formulated by interrogating huge volumes of data collected from everyone who does a web



▲ **G Suite Meeting cartoon**





#### ◀ G Suite Team Hangouts

search, sends an email, uses social networking and interacts with the firm's online services and apps. We've long-known Google's penchant for collecting masses of personalised data for its hugely successful advertisement targeting strategy, these source of its buckets of cash. Now, though, its billion-or-so daily Cloud Platform users is affording it ever-deeper insights into what apps we use, what we use them for and we'd ideally like them to work for us.

In addition, Google is expanding its cloud footprint. There'll soon be eight new Google Cloud Regions, which cover Mumbai, Singapore,

Sydney, Northern Virginia, São Paulo, London, Finland and Frankfurt. More may be added in 2017 to further geographically refine and tailor the options and data.

It's clear G Suite aims to battle head-to-head with products like Microsoft's Office 365, especially as Microsoft is suddenly adopting Google's approach and seems super-keen to use Windows 10 to collect and analyse as much consumer data as possible to its own end. So, you'd suspect, we can expect more intelligence to appear in these products too. However, as we begin 2017, Microsoft is set to jack up its UK business-level prices substantially, thanks to the collapse in the value of the sterling against the US dollar. Amazon and IBM offerings are likely to become more expensive too. This would make the G Suite pricing model look even more attractive if it holds at the levels we've discussed.

## Wrap Up

We'd all like to be more productive and get things done in a quick efficient manner, and Google wants to make this a reality. G Suite, on the surface at least, is all about trying to make that happen with a familiar set of apps and services. It's probably



▲ G Suite Jamboard

just the start, though. The promise is that G Suite will continue to grow as time goes by, and the recently announced Jamboard (see boxout) is a clue to how integrated G Suite will become with upcoming Google-made hardware and software products.

Whether all this added intelligence works for you or your company will depend on many different factors, but at least you can give it a try for free and find out for yourself – although, for things like Team Drive, you might need to sign up for the Early Adopter Program.

Is Google on the right track with G Suite? We'd love to know what you think so send in your thoughts to [letters@micromart.com](mailto:letters@micromart.com). **mm**

## Jamboard

Surprisingly the newest addition to G Suite family isn't another app, but a Google hardware product called Jamboard ([gsuite.google.com/jamboard](https://gsuite.google.com/jamboard)). Designed as the ultimate real-time collaboration space, this is a 55" 4K resolution touchscreen that aims to bring together the physical and digital worlds, either in the same room or with teams located around the world.

Anyone can join in a Jamboard session from any location just by running the Jamboard app, which is available for Android and Apple iOS devices. During the session they'll see a real-time feed from the board, to which they can contribute text messages, sticky notes, photos and drawings, which the session leader can share with all Google Hangout participants whenever they like.

On a tablet it's pretty easy to add various elements and rearrange them, but small screen smartphone interactions are, as you'd probably expect, more limited. However, it's worth noting that desktop or laptop users can only watch a Jamboard session. Only devices with the mobile app installed can fully contribute to what's happening on-screen.

The screen is pressure-sensitive when you're writing on it using your fingers or one of two chunky-sized passive stylus. Magnets keep the stylus secured to the Jamboard's metal base when not in use, but if they do go missing any rubber-tipped stylus will work.

Select the 'handwriting-to-text' tool before starting to scribble and your on-board writing is converted to searchable text. The software can also straighten your lines, shapes and symbols to keep everything looking neat and tidy. Plus everything you write or draw on the Jamboard is saved to Google Drive.

There are many collaboration features. Drag and drop images, maps, videos and web pages from search results. Snap pictures or selfies with the above-screen high-definition camera. Or watch video via the HDMI input ports or the built-in Chromecast facility.

Of course, Jamboard isn't a brand new concept. Microsoft has been pushing its rather similar 55" and 84" Surface Hub displays ([goo.gl/eTMitk](https://goo.gl/eTMitk)) for some time now. However, with a hefty price tag of \$20,000, the 84" version it is squarely aimed at the enterprise business marketplace.

Google says Jamboard won't be available until 2017, but at an expected cost of under \$6,000 it undercuts Microsoft's \$7,000 rival 55" Surface Hub. To see it action take a look at the official YouTube promo ([youtu.be/gXwV5SiKLAe](https://youtu.be/gXwV5SiKLAe)).

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# Drone Flies Into Prison

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## UK Drone Code Revised

**Safety first**

**T**he Civil Aviation Authority has looked again at the UK's Dronecode in order to help pilots fly drones in a safe manner. It's probably not a bad time to do this, with many drones expected to be handed out as gifts over Christmas period.

The Civil Aviation Authority has also noted that less than 40% of drone owners were aware of the Dronecode when they bought their new flying pal. So, without further ado, here is that revised Dronecode in full. Brace yourselves:

- **D**on't fly near airports or airfields
- **R**emember to stay below 120m (400ft) and at least 50m (150ft) away from people
- **O**bserve your drone at all times
- **N**ever fly near aircraft
- **E**njoy responsibly

Do you see what they've done? It spells... oh, never mind. Fly safe, people.

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## San Fran Transit System Hacked

**"If you're going to San Francisco, be sure to travel for free!"**

**O**ver 2,000 terminals within San Francisco's public transport network were impacted by some nasty ransomware late in November, with those responsible wanting to be paid in bitcoins to resolve things.

Ticket machines were shut down alongside various office systems, meaning passengers benefitted from free travel during a busy weekend while IT bods tried their best to get things back up and running.

The hackers wanted 100 bitcoins, which is around £50,000 in old money, to put things right. For its part, the railway's management team was emphatic in saying it "never considered paying the ransom".

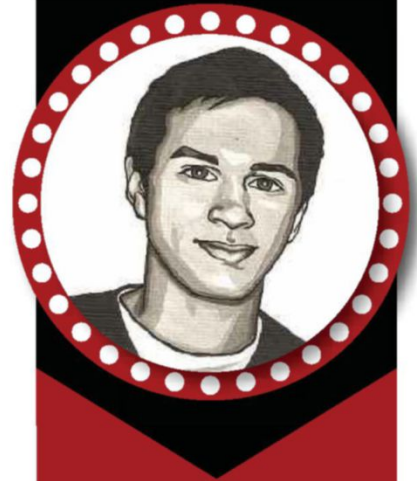
In other security news, a laptop containing the social security numbers of over 130,000 current and former US Navy sailors was breached, putting that information at risk. The US Navy said that there was no evidence the data has been misused, but it's troubling news.

### Successful drop but no damage done

**T**he Danish Prison Union has reported that a drone successfully flew various illegal items into a cell of one of its prisons with a view to helping an inmate escape. Carrying a couple of mobile phones, a saw blade and various bolts and managing to make it right over the prison wall

and through the prisoner's cell window before flying off again into the night, the drone's contents were thankfully spotted right away and seized. The drone got away, though, and whoever was flying the thing has also not been caught, reportedly.

Will the pilot try this again, we wonder? Or, if not the same person, someone else? Meanwhile, in other drone news...



Planning a new system build is always a balancing act. You want to get as much power and speed as you can, but you also have to be realistic about what you can afford. The same goes with any upgrade, in fact.

My most recent purchase was a new graphics card, after my old one not only started getting a bit long in the tooth, but I also managed to break part of it. For a while, I looked at Nvidia's new flagship card, before getting real and admitting I'd never actually be able to afford one.

Instead, I opted for an AMD card, one that I know will age a lot quicker than the more expensive models. It is, however, still a really good piece of kit, and I know that I should get at least another five years out of my PC thanks to its presence.

Better hardware will, of course, be just around the corner, but there's only so much looking to the future you can do before it drives you crazy. Nevertheless, if something great is coming soon, it can be worth waiting sometimes.

Nothing's ever simple, is it?

*Anthony*

# And It's GO GO GO!

### Gaming chairs from Vertagear

**S**o Lewis Hamilton couldn't pull another championship win out of the bag, but you could join him in feeling (a bit) like an F1 superstar thanks to Vertagear's latest line-up of gaming chairs that take inspiration from the F1 scene.

All three models – the TRIIGGER 275, TRIIGGER 350 and TRIIGGER 350 Special Edition – feature steel alloy dual spring hubs for reclined balance, soft padded armrests for enhanced comfort and holtron hubless casters for movement and durability. They also come with paddle-shifting 'triggers' in the armrests to adjust seat height and tilt angle, the idea being that this is like the paddle shift gear changes that F1 drivers use.

The chairs allow for a maximum of 22 different seated positions and the 350 model additionally comes with multi-directional lumbar support. These models are not cheap, starting at £530, but if you're serious about gaming then these could well appeal to you and your posterior. You can get them from Overclockers, and read more at the Vertagear website ([vertagear.com](http://vertagear.com)).



# Meanwhile... On The Internet...

If we're being honest, we were expecting to revisit the subject of the Mirai botnet on this page... and here we are, covering the news that customers of Hull's KCOM ([tinyurl.com/MMnet43a](http://tinyurl.com/MMnet43a)), UK ISPs Talk Talk and The Post Office, Germany's Deutsche Telekom ([tinyurl.com/MMnet43b](http://tinyurl.com/MMnet43b)) and Ireland's Eir all fell foul of the the IoT powered blighter last week ([tinyurl.com/MMnet43c](http://tinyurl.com/MMnet43c)) in attacks that appear to target specific models of router that they use, mainly models by ZyXEL and D-Link, it would appear.

These more recent problems, however, appear to revolve around the worm, or a derivative of it spawned from the code that leaked recently ([tinyurl.com/MMnet43d](http://tinyurl.com/MMnet43d)), trying to recruit said router hardware to join the thousands of internet-connected devices it can utilise in its DDoS attacks ([tinyurl.com/MMnet43e](http://tinyurl.com/MMnet43e)). This was seemingly confirmed in a Motherboard feature, which features text from an online 'chat' with one of the people claiming to be responsible for the problems ([tinyurl.com/MMnet43f](http://tinyurl.com/MMnet43f)). Indeed, the very civil-sounding hacker (who operates under the name of 'BestBuy') 'apologised' (or rather apolo-gloated – you can have that) for having knocked thousands of Post Office customers offline, before going on to claim that they weren't targeted "intentionally", and that the ISP should give its customers better kit, as "too many requests freeze the sh\*\*\*y routers" (the stars are ours).

However, like most idiots that try to sound civil while royally screwing people over, the person behind the renamed 'Annie' botnet (which, they claim, now has 4.8m devices within it, a figure that can't be confirmed as yet), is actually just engaging in textbook victim blaming ([tinyurl.com/MMnet43g](http://tinyurl.com/MMnet43g)). So thanks for that, BestBuy.

A few issues back we turned our attention to the advice given by the US town Bangor, Maine ([tinyurl.com/MMnet41h](http://tinyurl.com/MMnet41h)) on how it's residents should react to being approached online by strange members of the opposite sex, and how they should avoid being scammed into 'performing' for said people in a way that could leave them open to blackmail.

At the time, we reported on the matter in much the same dry and humorous (we hoped) way that the cops' advice was given, while still hoping to make a point. However, recent news regarding the increase in the number of suicides apparently related to such 'Sextortion' cases has made us regret that tone more than a little ([tinyurl.com/MMnet43i](http://tinyurl.com/MMnet43i)).

As such, we would not only like to highlight that cases such as this have more than doubled, and been linked to four suicides in the UK, over the last year. We'd also make you all aware of the new advice the National Crime Agency has on the matter

(paraphrased as 'Don't Panic, Don't Communicate, Don't Pay, Preserve Evidence': [tinyurl.com/MMnet43j](http://tinyurl.com/MMnet43j)), and that – like our good friends at *Den Of Geek* pointed out last week ([tinyurl.com/MMnet43k](http://tinyurl.com/MMnet43k)) – there are wonderful, non-judgemental, people like the Police, the Revenge Porn helpline ([www.revengepornhelpline.org.uk](http://www.revengepornhelpline.org.uk)), Papyrus ([www.papyrus-uk.org](http://www.papyrus-uk.org)), and of course the Samaritans ([tinyurl.com/MMnet43l](http://tinyurl.com/MMnet43l)) who are waiting to listen to you and help you deal with what may seem like a unresolvable situation.

Please, if you find yourself in a situation like this, or feel blighted by any issue that is pushing you towards considering suicide: talk to someone, and don't rush into anything. You really do matter. Be excellent to yourself.

If you pay any kind of attention to the world of tech news, you'll probably be aware of the ongoing code war between ad blocking software ([tinyurl.com/MMnet43m](http://tinyurl.com/MMnet43m)) and web-media companies that are reliant on advertising for their income, Facebook among them ([tinyurl.com/MMnet43n](http://tinyurl.com/MMnet43n)). You'll also probably have worked out that its one of those tit-for-tat ([tinyurl.com/MMnet43o](http://tinyurl.com/MMnet43o)) battles that nobody's ever really going to 'win' ([tinyurl.com/MMnet43p](http://tinyurl.com/MMnet43p)) until a detente is reached.

While it's been a subject of discussion here and in America, in Germany – to paraphrase The Who once more – it's been a 'legal matter, baby' ([tinyurl.com/MMnet43q](http://tinyurl.com/MMnet43q)). Specifically, Eyeo, the company behind the most popular example of such software, AdBlock Plus ([adblockplus.org](http://adblockplus.org)), in court defending its product against attacks from some of its home-country's biggest media brands. So far, however, in the six cases it has faced, Eyeo has a 100% victory record ([tinyurl.com/MMnet43r](http://tinyurl.com/MMnet43r)), save for a partial win by publisher Axel Springer ([tinyurl.com/MMnet43s](http://tinyurl.com/MMnet43s)), which may force it to cease the operation of its controversial 'White Listing' scheme ([tinyurl.com/MMnet43t](http://tinyurl.com/MMnet43t)), which demands large media companies with more than 10m ad views per-month pay to have their ads allowed through by the software – though, even then, only if they conform to AdBlock's strict 'Acceptable Ads' standards ([tinyurl.com/MMnet43u](http://tinyurl.com/MMnet43u)) and the users has selected that they are happy to see such ads.

While some see the scheme as a "protection racket" ([tinyurl.com/MMnet43v](http://tinyurl.com/MMnet43v)), Eyeo defends the scheme by saying that the money allows it to fight legal battles, like the one it's just won over *Der Spiegel* ([tinyurl.com/MMnet43w](http://tinyurl.com/MMnet43w)), that benefit all examples of such software, not just its own. Judging by the fact that several of the cases it has 'won' are, of course, going to appeal in higher courts, it's going to need that revenue going forward, one would suspect. As to whether there's a solution to the Ad Blocker issue in the long run, your guess is as good as ours to be fair.

## .AVWhy..?

The Make-A-Wish foundation does some truly amazing things ([www.make-a-wish.org.uk](http://www.make-a-wish.org.uk)); the kind of life-affirming gestures of kindness that make you feel a little more at ease about some of the sadness in the world. They can't make things right, but they can make them better, we suppose. Which brings us to Declan McLean-Pauley who, after battling leukemia and finding himself in remission, had a very simple wish: he wanted to 'blow stuff up'. Thanks to the the Australian Federal Police's Specialist Response Group, his wish was granted ([tinyurl.com/MMnet43x](http://tinyurl.com/MMnet43x)).



## Caption Competition



"I see the budget for Top Gear has been cut again."

What did you make of issue 1441's caption pic. Let's take a look, shall we?

- **Fallguy:** "Sure to win with my custom slipstream fins."
- **PlaneMan:** "Don't think much of this Asian Tesla 'clone'."
- **JayCeeDee:** "Yeah fine - you've fitted the crumple zone - when's the body shell coming??!!"
- **JayCeeDee:** "First there was the soap-box racers – these are the wine box racers."
- **JayCeeDee:** "I'm feeling a bit boxed in!"
- **JayCeeDee:** "When I said think out of the box, this wasn't quite what I had in mind!"
- **The Duke:** "It better not rain!"
- **Optional:** "I bet it was an Amazon delivery."
- **SpaceAlien:** "The latest model from Fiat harks back to the 1970s, It's starting to biodegrade already."
- **David Mullen:** "Laugh if you like. This led to the development of crumple zones."
- **David Mullen:** "In the unboxing video of the new Evo Origami, first you take the box apart then you stick it back together. Wheels not included."

Thanks to everyone who entered, especially CapComp regular Thomas Turnbull, who suggested this weeks winning wit "I see the budget for Top Gear has been cut again."

If you have a caption for the picture below, head to the 'Other Stuff' section of our forum ([forum.micromart.co.uk](http://forum.micromart.co.uk)), or email us via [editorial@micromart.co.uk](mailto:editorial@micromart.co.uk), remembering to add the issue number to the email subject line.



# Boy Pulled Over By Cops

## Love for GTA causes problems

While *Grand Theft Auto* is a fun franchise, and you will find many tales of gamers pulling off amazing heists and vehicular stunts to impress their friends, one 11-year-old boy in Canada liked the game so much he wondered what it would be like to do this kind of thing for

real... and so he got inside an actual vehicle and drove it, at speed, down a major highway in Ontario. Oh, what larks!

The police did eventually manage to pull him over before he caused a major injury to himself, or anyone else, but if ever people wanted proof of the bad influence of video games on today's youth...

# Japan Builds Fastest Supercomputer... It Hopes

## Project to finish by end of next year

The battle to be the keeper of the world's greatest supercomputer has a long and competitive history, and now trying to write itself into the record books is Japan.

With a view to having something fully-functioning by the end of 2017, Japan has begun building the world's fastest supercomputer and it's going to spend somewhere in the region of £140m to put together the

AI Bridging Cloud computer (AIBC). The aim is for the AIBC to run at 130 petaflops, which will make it faster than the current fastest computer on the block, China's TaihuLight.

In practical terms, the AIBC will be used to help with medical research, robotic AI, and other applications that are very current in this day and age (driverless cars, that kind of thing). Expect somebody else to announce a challenger soon enough, though.

## Snippets!

### EE's Super-Quick Speeds

EE engineers have boasted, quite rightly, of achieving speeds of 2.1Gb/s from a trial LTE demonstration, achieved alongside its partnership with Huawei. It's worth bearing in mind that this was an engineering test, so it's not a true-to-life demo of what can be achieved by consumers in the field – but 2.1Gb/s, wow.

### Dude, Where's My Car?

It's a common question... Maybe not in that exact phrasing, granted, but one that can now be answered by an iOS app called Tuture. It doesn't need any accessories to work, as the app automatically records the location of your car at the time you left it, with a parking entrance indicated on your mobile device if you left it in an underground car park.

You can manually input a location if you'd prefer and, as well as letting you know where you left your vehicle, plans are a foot for the app to inform users in real time when a parking space becomes available close to your car. Read more if you're interested over at [www.tuture-car-locator.com](http://www.tuture-car-locator.com).

### German Users Cut Off

Up to 900,000 customers of Germany's Deutsche Telekom were cut off from their broadband after – yes, you've guessed it – someone was suspected of hacking into the company's hardware. The problem seems to have affected owners of certain routers, leading the company to make the following statement: *"Based on the error pattern, we cannot exclude the possibility that the routers have been targeted by external parties with the result that they can no longer register on the network."*

There have been a few too many hacking stories to report in this week's news, we're afraid. Nasty business.

# Snoopers' Charter Petition Reaches Key Target

## Parliamentary debate over new act?

**U**nhappy with the introduction of the new so-called Snoopers' Charter? You are far from alone as a petition calling on the government to recall the bill has amassed over 100,000 signatures.

The significance of this is that the Investigatory Powers Act, to give it its full title, must now be considered for a full debate in Parliament. Of course, it's hugely unlikely that this petition will have any real impact on the decision to implement the bill, but it does rather show the strength of feeling the man in the street has regarding the wildly unpopular piece of legislation

that Prime Minister May has agreed to bring in, most likely by the end of the year.

The Snoopers' Charter, just to remind you, will mean Internet providers will have to record what websites and messaging apps its customers connect to, although the information is at domain name-level rather than the individual pages within that. With information being held for a year, and able to be shared with the government and other bodies on demand, it's entirely understandable why people might not be best pleased about this coming into law.

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# BullGuard Upgrades Internet Security

## Greater cloud storage security

**A**nti-malware protection software BullGuard Internet Security has been handed a revamp, with its latest version offering greater protection for cloud storage services such as Dropbox and Google Drive. Providing protection across PC, Mac, and Android devices – including smartphones and tablets – all from the one licence, you can also try a free 60-day trial over at [www.bullguard.com](http://www.bullguard.com).

Among its functionality, you can put in place one-click simple backups or more advanced scheduled backups made at pre-determined intervals, encrypt files and folders before they leave a system, and protect against ransomware, all under enhanced performance compared with previous versions of the package. BullGuard Internet Security will set you back £50 a year if you decide to go ahead.





# Bletchley Plans School For Coders

**Planned for 2018 opening**

**B**letchley Park, famous for its role in the war effort, is reportedly planning to open a new school that will teach cyber skills to 16-to-19-year-olds. The very serious-sounding College of National Security is planned to be opened up in 2018 in a building on the Bletchley site itself that will have to be restored first.

The College will be a sixth-form boarding school that will be free to successful applicants as reports have

suggested that funding could come from a combination of state and private financing, which will be necessary as this is going to be a multi-million pound venture.

The school will be looking to select potential students on talent alone, with – as well as cybersecurity – pupils being taught related subjects such as physics and maths. Anyone who can't take advantage of the boarding school option could potentially undertake one of its virtual short courses online.

# Amazon Limits User Reviews

**Attempt to stop fake feedback**

**A**mazon has announced a plan to limit the number of weekly reviews a shopper can make on the site. From now on, Amazon users can write just five reviews of items they haven't bought via the retailer in any given week. The idea, which is fair enough, being to stop people from selling positive comments. Just as Facebook is promising to act against fake news, so Amazon wants to put an end to fake

reviews, although if goods are indeed verified as having been bought from the retailer then there are no limits placed on the number of those reviews.

Amazon could also take a closer look should a product receive "unusually high numbers" of reviews over a short period of time, writing "we may restrict these products to Amazon Verified Purchase reviews". One exception to all of this: books don't come under the new restrictions.

**amazon.co.uk**

# Reddit Head Admits Editing

**Naughty naughty...**

**T**he CEO of Reddit, Steve Huffman, has admitted to editing users' posts on the site. The posts were made on the subreddit thread about President-Elect Donald Trump, r/the\_donald, concerned Huffman himself, and were largely not very nice. Thus, he decided to use his access to replace any mentions of his own username with the names of moderators of the subreddit, directing the abuse towards them instead, or so it looked.

Online abuse is a horrible, horrible thing – nobody's going to question that – but Huffman knows that he really shouldn't have done what he's done. In a post on the site, he confirmed that some of his own colleagues were angry with him over this, and that Reddit members have, obviously, reacted angrily too, accusing Huffman of censorship. He added: "As the CEO, I shouldn't play such games, and it's all fixed now."



## WebSite X5 Professional 13

Joe checks out a new release from Incomedia

### DETAILS

- Price: WebSite X5 Professional 13 £149.00, WebSite X5 Evolution 13 £49.99, WebSite X5 Start 13 £ 14.90
- Manufacturer: Incomedia
- Website: [www.website5.com](http://www.website5.com)
- Requirements: Windows XP or later, 1 GB RAM



▲ With over 1000 templates to choose from, it shouldn't be difficult to get started



▲ The quick preview option shows how your project is developing

The internet is constantly changing with new developments that make our lives more informed, more entertained and easier to shop. These changes are mainly driven by websites all vying for our attention and of course our business. This means the websites themselves need to incorporate the latest eye catching designs to make your mouse finger pause just a moment longer.

Incomedia is one of the companies that help us mere mortals hit this constantly changing target, with web design software that's powerful, easy to use and more importantly embraces the latest technology. The company produce three versions of its web design software, Start, Evolution and Professional. This review is based on its professional version, which along with the other two, has just been updated to version 13.

If you've ever dabbled in website design, you'll know there are three approaches that design programs normally adopt. The first is the original method that entails a good knowledge of HTML code, and is not used that much today, because it naturally takes much longer to complete. The second is the page layout method, where you

place each element on the page you're creating. Or thirdly, the method that WebSite X5 adopts is by using frames where you compose your images, text or other content before they're added to the page. To see how it's going so far you simply click on the preview button. While this is not exactly intuitive, the program does walk you through every step, and I've found this approach makes for very efficient (so smaller file size) coding. In some ways I guess it's an advantage if you've had no experience of other web design products.

There are a number of new additions to the program but

possibly the most important of these is the move to full 64 bit; this has greatly improved the speed and consequently the usability. The developer claims a 50% increase. While I don't have the means to confirm that figure, the increase is certainly noticeable.

One of the most impressive features new to this release is Parallax scrolling, an eye-catching effect that many of the top sites are currently using. It scrolls the sites main content over a background that scrolls at a different pace to the content, giving almost a 3D effect. In some ways to complement this, it's added sticky menus to your

arsenal, so while your content is scrolling the menus stay fixed and is always available.

If you're short on ideas or need some fresh content, X5 has it covered. With over 700,000 royalty free images to choose from, and lots of prebuilt forms that cover everything from emails, to product catalogues, you're sure to find enough data to get you started.

I think most people would agree that possibly the most difficult thing to do when creating a website is getting it noticed by the various search engines – what's generally known as SEO (search engine optimisation). Well, the code created by this latest version of X5 gets your site indexed very quickly; all you need to do is add a few lines of text using the Object Title feature and X5 does the rest.

Finally, if you want to give the program a try, you can download a fully working (time limited version) from the company's website. After purchase, you also get the free registration of a domain of your choice, plus 15GB of web space for 12 months, unlimited emails and a cloud drive service for synchronising files on all your online devices. **mm Joe Lavery**

**Usability and capability have both been improved by this update**



# Linksys LGS108P 8-port Desktop Gigabit PoE Switch

Linksys makes PoE a much more affordable choice

## DETAILS

- Price: £74.99 (Ebuyer)
- Manufacturer: Linksys
- Website: [www.linksys.com/gb/p/P-LGS108P/](http://www.linksys.com/gb/p/P-LGS108P/)
- Requirements: Ethernet network



For those working in business IT, flexibility is the name of the game, because for whatever reason, many companies don't involve their technical people in business planning and then jack-in-a-box their demands on them when they make changes.

A typical instant requirement is the relocation of people and their systems to parts of the building where there aren't lots of Ethernet ports.

New cabling is one option, but short timescales can mean a better one is to use a product like the Linksys 8-port Desktop Gigabit PoE Switch, the LGS108P.

From the outside, this appears very similar to the types of switches many home users might deploy, but looks can be deceiving. What it shares with those inexpensive expensive options is the 8 ports of

10/100/1000 Ethernet connected via a high-performance backbone (16Gbps in this case) and the typically understated aesthetic.

However, professional IT needs require more than connectivity, and to that end Linksys added 802.1p and DSCP quality of service functionality.

But the real enhancement here is that the first four ports of this device are PoE (power over Ethernet), and included in the box is a larger than expected PSU to provide the 50 watts extra that the LGS108P can send along with data.

For those wondering if sending power over Ethernet is a good idea, there are safeguards in place under the IEEE 802.3at (PoE+) standards it was built on.

Original PoE designs reduced the data bandwidth by requiring dedicted wires, but in this

design at gigabit speeds all wires are used for power and data using a method called the 'Phantom technique'.

What PoE provides is an easy means to deploy equipment where there isn't a conveniently placed power socket but where you can easily send an Ethernet cable.

The obvious uses are security cameras and VoIP telephones, but there are lots of PoE-powered gizmos to choose from.

If the four PoE or eight data connects are insufficient for your needs, then Linksys also has the LGS116P and LGS124P that expand data connectivity to 16 and 24 ports respectively and bump backbone bandwidth up accordingly. They also have more PoE supporting ports (eight and 12) and a greater power budget to divide between them.

The only minor blot on this manicured landscape is that all these switches are unmanaged, so they're not really designed to be at the centre of a network but more peripheral.

Discrete and easily wall mountable, this is exactly the sort of hardware that an IT manager needs on the shelf when the call comes that they've hired a new telesales team and its going where there is little or no infrastructure to support them.

Given the premium cost that PoE hardware is associated with, this hardware is also rather cheap, and therefore potentially of interest to anyone who is installing a home security system in their own property.

**mm Mark Pickavance**

**A built for purpose eight-port switch with extra PoE sauce**

## Network Standards supported by LGS108P

- IEEE 802.3
- IEEE 802.3u
- IEEE 802.3x
- IEEE 802.3ab
- IEEE 802.3az
- IEEE 802.3af
- IEEE 802.3at Type 2 (PoE+)



# Asus Chromebox 2 CN62

A new Chromebox design from Asus offers a minimalist nirvana

## DETAILS

- Price: £199.99 RRP
- Manufacturer: Asus
- Website: [www.Asus.com/uk/Chrome-Devices/Asus\\_Chromebox\\_CN62/](http://www.Asus.com/uk/Chrome-Devices/Asus_Chromebox_CN62/)
- Requirements: Monitor with HDMI or DisplayPort input, Wireless or Wired Broadband
- Part No. 2-G084U



While back, Asus added some Chromebox systems to its inventory, and now it's refreshed them with a second series of modestly updated designs.

It sent me the entry-level model, part number 2-G084U, to see what's improved and if this makes its Chromebox 2 offering even more desirable than its predecessor.

As computers go, this was is small, even by Chromebox 2 standards. The flattened box is just 12.4cm square and 4.2cm high. Inside, Asus has managed to shoehorn a complete Intel-based PC. In this model, it has a dual-core

Celeron 3215U, 4GB of RAM and 16GB of SSD storage.

For those wanting greater computing power, Asus also offers Core i3 and i7 variants of this platform, though unless you want to hook this system up to a 4K display for video I don't really see the need.

## Specification

**Processor:** Celeron 3215U dual core 1.7GHz 2MB cache.

**Memory:** 4GB DDR3L SoDIMM.

**Storage:** 16GB M.2 SSD.

**GPU:** Intel HD Graphics.

**WiFi:** Intel dual band 802.11ac + Bluetooth 4.0.

**OS:** Google Chrome OS.

**Accessories:** VESA mount, wireless mouse and keyboard.

**Ports:** 4 x USB 3.0 (2 front, 2 rear), 1 x DisplayPort, 1 x HDMI, 1 x headphones/microphone – mini-jack, 1 x LAN (Gigabit Ethernet).

**Power adapter:** 65 watts maximum.

**Dimensions (WxDxH):** 12.4 cm x 12.4 cm x 4.2 cm.

**Weight:** 600 g

“ You really begin to wonder why you need Windows ”

You can also dismantle the box and manually upgrade the RAM and storage. That might be a valid plan if you want to repurpose this system with Ubuntu or some other Linux distro of interest. Because this is a PC, intrinsically, those things are all possible.

However, what this system is primarily built for is running Chrome OS, and that it does very nicely indeed. Out of the box you simply connect it to an HDMI or DisplayPort monitor and a Ethernet connect, and you're ready to

rock. Included in the box is a wireless mouse and keyboard, and the dongle that connects them using USB to the system. This does take up one of the four USB 3.0 ports on the Chromebox, but not internalising the dongle means you can use these peripherals elsewhere.

What was good about all them was that there was no 'pairing' or similar exercise. I just inserted the dongle and batteries into the input devices, and it all just worked.

Once you've given the system a google account and



wi-fi password, you can dispense with the Ethernet. And the provided mounting plate enables you to attach this to the rear of a screen with VESA standard holes, and make your own self-contained system.

The obvious limitation of Chromebox is that it can only

use web-based applications, or Chrome apps, though access to the Google's Android Play store is also promised at some point in the future.

This was originally going to be in 2016, but it's been pushed back because Google needed more time to make it

work more like people will expect.

For Windows, a Celeron 3215U and 16GB of storage just wouldn't cut it, but on Chrome OS that spec is more than acceptable, and delivers web performance bordering on snappy. On this implementation, it's even added animation so windows resize smoothly with transition effects. This demonstrates that the Celeron is probably not stressed doing these jobs, and easily performs these menial tasks.

If you need more local storage, then you could just insert an SD card into the 4-in-1 card reader, or you could use a USB flash drive or an external hard drive.

However, the best upgrade would be to flip the internal M.2 SATA drive out and replace it with something larger. If you do this, it's a relatively straightforward exercise to reinstall Chrome OS, if you want.

While doing this does offer some interesting possibilities, Chrome OS is really designed to work with cloud-based

documents and therefore isn't really storage dependent.

As if to highlight this, all Chromebox 2 purchasers automatically get an extra 100GB of Google Drive space free for two years, covering all but the most extreme file hoarding eventualities.

This is by far the best Chrome OS experience I've had so far, and it illuminated for this writer how far Google has come in making this a viable alternative to traditional desktop operating systems.

A few hours with this and you really begin to wonder why you need Windows for the majority of tasks you perform on a daily basis. It won't do everything, but it does much more than you might imagine.

For those who want portability, then obviously a Chromebook is more suitable. But for those who want a simple, almost silent, low-maintenance alternative to a conventional PC, the Asus Chromebox 2 is pushing all the right buttons.

**mm Mark Pickavance**

### Highly responsive Chromebox for all your Chrome OS needs



# Speedlink Decus Respec Gaming Mouse

A new generation peripheral, with a few added extras

## DETAILS

- Price: £44.99
- Manufacturer: Speedlink
- Website: [goo.gl/HWCWPN](http://goo.gl/HWCWPN)
- Requirements: Windows Vista or later for management software, spare USB port

A couple of years ago, Speedlink launched the Decus Gaming Mouse, a high-end gaming peripheral complete with numerous LEDs, adjustable DPI settings, and a range of programmable buttons. The Decus was also one of the most competitively priced gaming mice available at the time, which made it hugely successful.

Now the company has launched its successor, the Decus Respec Gaming Mouse, along with some subtle changes, better design and a brand new feature.

The Decus Respec's design, to the eye, doesn't look too different from the former model that came out in 2014. However, it's slightly wider, and the contours flow around the mouse, from the ends of the buttons to the elegant rise in the back, in more ergonomic style. This not only makes it a very comfortable mouse to use for long periods, but also one that remarkably stylish.

With ergonomics in mind, the base of the mouse spreads out on both sides, with the left-hand side allowing the thumb to rest easily against the side of the mouse, and within easy reach of the two side buttons. Likewise, the right-hand side is ridged to



▲ The Speedlink Decus Respec combines style and good ergonomics



▲ The new weight system and better customisation makes for an excellent gaming mouse

allow the right-hand finger ring and little finger to rest into while using the mouse. All of this makes for a relaxed position while in use.

The high degree of customisation is still present with this new version of the Decus, with five profiles available, adjustable DPI settings from 400 to 5,000, seven coloured lighting

options, a configurable polling rate up to 1000Hz, and seven programmable buttons. The biggest difference between this version and the last is the introduction of a custom weight setting. On removing a section at the base of the mouse, you can install or remove four 4.5g weights. Without the weights, the Decus Respec weighs 127g,

but with them that weight is increased to a sturdy 145g.

Along with the Decus Respec comes the Speedlink configuration manager. While most configuration software tends to blind the average user with unnecessary GUI options, Speedlink's approach is quite minimalist. On the surface, it's a light, easy-to-read setup tool that allows you to change the DPI, LED colours and which profile you're currently using. Dig a little deeper, though, and you'll hit the section where you can program the buttons, add key commands and access the macro functions. Again, though, this is laid out in a simple and easy-to-understand set of function boxes and options – something other peripheral management developers should take note of.

While a custom weight system, adjustable buttons and internal memory isn't something new to mice, it's refreshing to see that Speedlink has managed all of the above while still keeping the Decus Respec at around £44.99.

We liked the Speedlink Decus Respec Gaming Mouse. It's a comfortable, useful and configurable mouse that, while offering high-end gaming credentials, still manages to keep things simple for the rest of us.

mm David Hayward

A great, value for money gaming mouse





# Speedlink Omnivi Core Gaming Mouse

A new weapon to add to your online arsenal

## DETAILS

- Price: £59.99
- Manufacturer: Speedlink
- Website: [goo.gl/gvH0IT](http://goo.gl/gvH0IT)
- Requirements: Windows Vista or later for software, spare USB port



▲ There's loads of features, LED lighting and programmable options to enjoy

Speedlink recently unveiled a pair of gaming mice at Gamescom: the Decus Respec, which we've reviewed in a previous issue of Micro Mart, and this, the Omnivi Core. (In case you're interested, the name comes from Omni Visualise.)

The Omnivi is quite similar in design to its sibling Decus Respec, with some subtle differences. There's the flaring of the mouse chassis at its base, allowing you to rest your right-hand ring and little finger on an extended aluminium shelf, while the thumb rests on a smaller extended section. The two main left and right buttons are indented to comfortably fit the fingers, and the rear of the mouse rises gently to fill the palm of the hand.

It's a good ergonomic feel, and Speedlink has done an excellent job of making the mouse look as smooth-lined as possible, while still keeping the gaming aggressiveness that is now the accepted norm for gaming peripherals. The rubberised finish and all aluminium chassis, 1.8m braided USB cable and precise laser sensor all make for a sturdy and professional

▲ The Omnivi Core is a cracking gaming mouse

gaming mouse in a highly competitive market.

The Omnivi has ten freely configurable buttons, which also include four side-mounted thumb buttons that by default activate forward, back, automatic (or rapid/continual) fire, and a Sniper Mode, which when pressed will lower the DPI to allow you to focus in on a target while looking down the scope of a rifle.

In addition to the side buttons, there are also a couple of media volume buttons positioned just above the left-click button, raised slightly, within easy reach of the finger. As we mentioned, each of the buttons can be configured to pretty much anything you want across any of the five available profiles. There's also a macro recorder and editor to extend the functionality further.

The software, beyond the profiles, button setting and macro assignments, can alter

the LED lighting that surrounds the bottom of the mouse, the wheel and an area on the back with the Omnivi logo. There's the option to configure the DPI settings from 800 to an impressive 12,000, and to adjust the polling rate up to 1,000Hz.

In use, the Omnivi performs extremely well. It's accurate, sensitive and is very comfortable to use over long periods. One issue we've had with mice featuring a side-mounted set of buttons is our reflex pressing of those buttons when we don't want to. If you suddenly swipe to the left, there's a chance your thumb can hit one of the side buttons, causing you to do something you weren't expecting, which when in a competitive game can have a sizeable impact. The Omnivi, though, manages to avoid this issue, with the buttons being slightly spread apart around the thumb position and a little

harder to depress than the other buttons on the mouse.

There are some good design decisions used throughout the Omnivi that we really appreciate. Speedlink has released a competitive mouse that ticks all the right boxes in terms of performance and features, and it only costs £59.99.

Another well-presented and designed peripheral from Speedlink – one that's certainly worth purchasing.

**mm David Hayward**

**An excellent mouse, with tons of features and great design**



# Thermaltake Engine 27 1U CPU Cooler

Mark discovers how processor fans can still be cool

## DETAILS

- Price: £36
- Manufacturer: Thermaltake
- Website: [www.thermaltake.com/](http://www.thermaltake.com/)
- Requirements: Intel Socket LGA 1150/1151/1155/1156 system

It's been a very long time since I've seen anything really new in CPU air coolers. These days they're invariably an elaborate dust attracting metal structure through which fans blow air to extract the heat.

Thermaltake's Engine 27 might look exactly like that, initially, but closer examination reveals an innovative design that harks back to the work of researcher Jeff Koplow, at Sandia National Labs.

What Thermaltake has realised in cooperation with CoolChip Technologies is technically an 'Air Bearing Heat Exchanger', where the fan itself is part of the cooling mechanism and not just lightweight air propelling blades.

That makes Engine 27 the first of a new series of Engine X coolers that use 'Kinetic Cooling' designed by CoolChip Technologies to transfer heat across an air gap region into a rotating heat-sink impeller.

The theoretical advantages of doing this are numerous. Conventional designs create an insulation boundary layer of air around the cooling fins that's difficult to disturb even with the strongest fans. With those parts moving, a centripetal force acts on that air layer, spinning it away and dragging in cooler air.



How this is implemented on the Engine 27 is for the central part of the cooler to rotate sucking air in a vortex action and then forcing it out sideways through a ring of static fins arranged in a ring around the edge.

The base creates a thermal bond between the CPU and the device, and heat can move through it to both the static and mobile parts of the device. The central spinning section sits in a series of concentric grooves that allow heat to migrate easily to it, and a bearing avoids metal surfaces coming into physical contact with each other.

Clever tech enables this to also be a remarkably small solution compared with many equivalent

designs, its name being derived from being just 27mm high.

That makes it perfect for 1U rack mounted solutions or micro-ITX systems where vertical space is often extremely limited.

At this time, Thermaltake has only made this available for LGA 115X platforms, and it comes with a rear mounting plate to attach to any system with the hole arrangement shared by LGA 1156, 1155, 1151 and 1150.

In terms of the cooling from a device that's just 27mm high and weighs 310g, it's surprisingly good, though successful is dependent on what spec of CPU is under it.

Thermaltake quotes that Engine 27 is designed to ship 70 watts of heat. That makes the

fastest Skylake CPU you could use with it is the i5-6600 (not K variant), and for Haswell owners it would need to be a Lower Power or Ultra Low power type ending with a 'T' or 'S', and not a K or any model without a letter designation.

The fan assembly can rotate between 1500 and 2500rpm, and even at top speed it only generated 25dBA. At lower speeds it's an almost silent 13dBA, and Thermaltake is quoting an operating life of 50,000 hours – that's 25 years of eight-hour working days.

The Engine 27 makes me curious if Thermaltake can make something a little bigger that could handle i7 class processors, while retaining many of the advantages of this one.

**mm Mark Pickavance**

**Perfect for 1U and small media systems**





# Sennheiser PXC 550 Headphones

Expensive audio equipment, but does sound as expensive as it should?

## DETAILS

- Price: £329.99
- Manufacturer: Sennheiser
- Website: [goo.gl/QvJIRO](http://goo.gl/QvJIRO)
- Requirements: Bluetooth enabled device, Line-in port



▲ The design and quality of the PXC 550 is as good as you can get



▲ There are tons of features, but the audio quality isn't as great as you'd expect

Audio experts Sennheiser's new wireless range of headphones are designed with the serious audiophile in mind. These are expensive, high-quality headphones with ample technology used to ensure the best in both comfort and sound. But are they worth the cost?

The PXC 550 are the mid-range model out of the Sennheiser wireless series, with the Momentum and Urbanite series filling in the rest of the range. These over-ear headphones are impressively designed, with ample cushioning on the headband and the ear cups.

They're quite sturdy too. With a combination of high-quality plastic and aluminium used throughout, along with synthetic leather and a tough headband adjustment section, they're sure to endure regular use, as well as being chucked in a bag when needed. A hard, cloth-covered case is included too.

The design is very minimalist, with the ear cups sitting snug against the side of the head and offering small, unobtrusive buttons on the underside of one of the cups. The design of cups is a point of interest here, as they're ovoid and fit around the shape of the ear more precisely than conventional circular ear cups.

This fitted feel does wonders for noise cancellation, but Sennheiser

has also included its own unique noise cancellation technology called NoiseGard Hybrid, which actively measures the external ambient environment noise levels and increases power to the anti-noise function – which, according to the blurb, will create a phase-inverted sound field to cancel out any unwanted noise. We'll leave you to look up the details regarding that.

As such, the PXC 550 does a wonderful job of immersing you in whatever it is you're listening to, be that games, movies or music. Having Bluetooth 4.2 connectivity

means it'll happily talk to any of the devices currently available, and the built-in, in-line microphone will allow you interrupt the music to take any calls from the device.

The right ear cup acts as a touch-sensitive control for the media on the device you're connected to. So a vertical swipe on the ear cup's surface will alter the volume levels, horizontal swipes move forward or back through tracks, and taps act as play and pause. You can even double-tap the rear of the ear cup to push external/outside noise through the headphones, via the

microphone. That way you're not likely to miss an announcement on a train, for example.

There are plenty of other features that the PXC 550 boasts, such as powering off simply by folding the ear cups flat, configuring them to automatically pause when you take them off, and resume playing when they're replaced back over your ears. And the battery is rated to last up to 30 hours off a single charge.

Despite the impressive use of technology, we weren't all that moved by the sound quality. While still extremely good, we must admit to having heard better sound reproduction from a gaming headset that costs a fraction of the price the PXC 550 is selling for. Don't get us wrong – the sound quality is certainly very good, but it could be better.

Considering this is a headphone set that costs £329.99, we were expecting something quite remarkable. The noise cancellation, and connective technology is great, but the result is a slightly less than wonderful audio experience for such expensive headphones. In short, if possible, it's best to test the Sennheiser PXC 550 before committing to a purchase.

**mm David Hayward**

**Great use of technology, but not so great sound quality**



# BUYER'S GUIDE

## AMD Motherboard From £100

We had an Intel motherboards from £100 buyer's guide a few weeks ago. Now it's the turn of AMD, with six motherboards waiting to be tested.

## AMD Motherboard From £100

### Gigabyte GA-F2A88XN-WiFi

#### DETAILS

- Price: £101
- Manufacturer: Gigabyte
- Website: [goo.gl/QZYr6i](http://goo.gl/QZYr6i)
- Requirements: Socket FM2+ AMD processors, DDR3 memory

For those wanting to build a small PC without compromising on performance, the Gigabyte GA-F2A88XN-WiFi is an excellent foundation.

With support for AMD A-Series, FM2+ Socket and Athlon series processors, an AMD A88X chipset, a pair of DDR3 DIMM sockets and, as the name suggests, a built-in 802.11ac wireless card, there's pretty much everything you'll need for a decent small PC.

On the board, there's ample connectivity: a single PCIe x16 slot, with support for AMD dual graphics technology, provided you have the right A-series APU in place. And there's also a single mini-PCIe slot, which is used up with the wireless module. There are four SATA 6Gbps connectors on the board, and the rear I/O backplate offers a single PS/2 keyboard/mouse port, a pair of HDMI ports, one DVI, two USB 3.0 ports, four USB 2.0 ports, gigabit Ethernet, optical S/PDIF out and a five-port audio block.

Obviously, it's a mini-ITX motherboard, which while perfectly fine, does have some disadvantages. Being just 170mm square, there are limited possibilities for further expansion in the future, should you decide to include a TV card, for example. And if you want to build a small gaming PC, you'll



▲ The tiny Gigabyte GA-F2A88XN-WiFi offer the small system builder a good base

need to double-check the clearance of the graphics card with the CPU heatsink mounting blocks. There's also limited room when both the memory slots are occupied and an average, stock-sized cooler is in place. In short, it can get a little cramped very quickly.

However, despite the limitations brought on by its size, the F2A88XN does include Gigabyte's Ultra Durable components and features. Things like solid caps, humidity protection, dual UEFI BIOS, surge and power failure protection are the norm. Plus with an appropriate APU in place, as well as an AMD GPU, the Dual Graphics Technology is certainly a benefit for those wanting faster than average frame-rates.

In addition to the above, the F2A88XN is a well-designed motherboard. Gigabyte has done a good job of managing to shoehorn in a fair amount of technology within the limited confines of the motherboard. It may lack some of the flair we've seen in more recent motherboards, such as LEDs along one side and, in all fairness, it is a pretty dull-

looking piece of technology, but considering 90% of builders don't really care too much about the inner aesthetics of a PC, there's little to worry about on this account.

There's plenty to like about the Gigabyte GA-F2A88XN-WiFi, with its connectivity, the added wi-fi element and its compact dimensions. With the right components in place, you can easily build yourself a decent media or small gaming PC – even a compact VR machine if that's something you're aiming for – for the reasonable price of around £101.

On the whole, then, a good and reasonably priced tiny AMD motherboard.



## Asus A88X-PRO

### DETAILS

- Price: £115
- Manufacturer: Asus
- Website: [goo.gl/p06vK8](http://goo.gl/p06vK8)
- Requirements: Socket FM2+ AMD processors, DDR3 memory

The Asus A88X-PRO is a couple of years old now, but has proved itself to be one of the better AMD Kaveri FM2+ socket motherboards available. The reason why is quite simple: it's a performance and enthusiast's motherboard, supporting Trinity, Richland and Kaveri processors, while costing just £115.

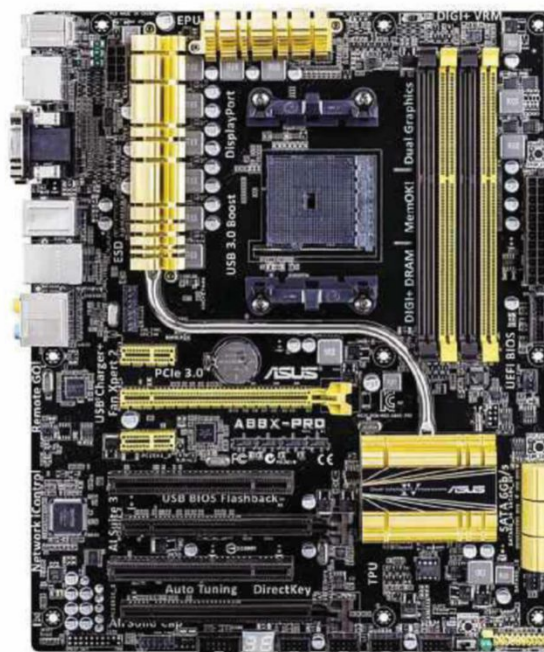
On the board you'll find eight SATA 6Gbps ports, four DDR3 DIMMs, two PCIe 3.0 x16 slots, a single PCIe 2.0 x16 slot, two PCIe 2.0 x1 slots and a pair of legacy PCI slots. Obviously the latter can take a wealth of multi-GPU configurations and there's even AMD Dual Graphics Technology for those with the right APU in place.

The rear I/O isn't lacking either, with a single PS/2 keyboard and mouse port, DVI, VGA, DisplayPort, HDMI, two eSATA ports, four USB 3.0 ports, two USB 2.0 ports, gigabit Ethernet, optical S/PDIF out and a five-port audio block. Needless to say, enough to accommodate most users.

The A88X-PRO is naturally an ATX form factor motherboard, so there's ample room for all the components to fit together without fear of one touching the other, including plenty of room for larger CPU coolers. It's good to see that there's also plenty of room



▲ There's lots to like about the Asus A88X-PRO, but it does lack in some technology



▲ With an M.2 port, for example, this would really shine for the price

between the PCIe lanes for multiple graphics cards, although if you load the motherboard out with a three-way GPU setup and a legacy PCI card, you may find things becoming a little tight between PCIe slots five and seven.

Interestingly Asus has done a good job of designing the A88X, with regards to the multi-GPU setup. For example, the southbridge heatsink is low profile, allowing graphics cards to slot into place with clearance. There's also a gold/

yellow component and black/brown PCB style in place, which can look a little gaudy for some.

Since this is a performance motherboard, there's plenty of overclocking opportunities available, either via the BIOS or the Asus AI software suite. You can clock the APU as well as the CPU side of things, and with Asus 5X protection you're covered in case anything should go wrong during the process. Incidentally, the UEFI BIOS has been drastically improved compared to the last-generation Asus motherboards. Even with it being a couple of years old, it's still a quick, easy and intuitive BIOS, which makes the process of overclocking, even to a small degree, something a novice could happily handle. We especially liked the fact that you can write notes in the BIOS reminding yourself of any changes you've added in the past.

All in all, the Asus A88X-PRO is a good AMD motherboard. It's reasonably priced, covers virtually every connection (minus the more modern M.2 ports etc.) and scores points with enthusiasts and performance system builders. It's well designed and works like a charm.



## AMD Motherboard From £100

# MSI 990FXA Gaming

### DETAILS

- Price: £135
- Manufacturer: MSI
- Website: [goo.gl/rkV8zK](http://goo.gl/rkV8zK)
- Requirements: Socket AM3+ AMD processors, DDR3 memory

**M**oving up the price scale we have an entry from MSI's Gaming range, which was released late last year and ticks all the right boxes for those wanting to build the ultimate AMD-based performance and gaming system.

The 990FXA Gaming is an AM3+ Socket motherboard that, along with six SATA 6Gbps connectors, features four DDR3 memory slots, three PCIe x16 slots, two PCIe x1 slots and a single legacy PCI slot.

The rear I/O backplate houses a single PS/2 keyboard and mouse port, eight USB 2.0 ports, a pair of USB 3.1 ports, gigabit 'Killer' Ethernet, optical S/PDIF out and a six-port audio block. The eagle-eyed among you will have undoubtedly noticed that the rear I/O is sadly lacking in any video outputs, which is a shame, as you're now locked into buying a graphics card as opposed to utilising the, realistically half-decent, AMD APU technology.

As we mentioned above, this is a performance motherboard, designed for multi-GPU gaming setups and extreme overclocking. As such, MSI has supplied the 990FXA with an arsenal of gaming features. The likes of Audio Boost offers high-quality sound production,



▲ The MSI 990FXA Gaming motherboard is pretty impressive looking



▲ It's an ideal foundation for a performance and gaming system

along with EMI shielding and the Killer gaming LAN port is said to eliminate lag, boosting in-game communication between your PC and the server by prioritising the gaming specific traffic.

In design, the 990FXA has military class components, adhering to MSI's strict focus on quality. And of course the overall design and layout of the motherboard bears a sporty, aggressive gaming look, complete with MSI dragon

badge southbridge and a black and red theme throughout with a red LED indicating the isolated audio PCB.

Alongside the hardware and looks, MSI's Click BIOS 4 makes an appearance. This is one of the best UEFI BIOS examples currently available, although in all fairness it does lack the hand-holding element that the Gigabyte UEFI BIOS has. Within Click BIOS 4 you can set all manner of overlocked or custom settings quickly and easily, as well as various profiles that can be activated with a click of a mouse button.

The MSI 990FXA Gaming is certainly an impressive motherboard. It has everything a performance system builder is looking for in a motherboard and it only costs in the region of £135. However, by its gaming nature it has alienated itself from the vast majority of other system builders, those who still want a performance system but require elements such as rear I/O video outputs, for example.

Still, for the price, there's a lot to like about the MSI 990FXA Gaming motherboard.



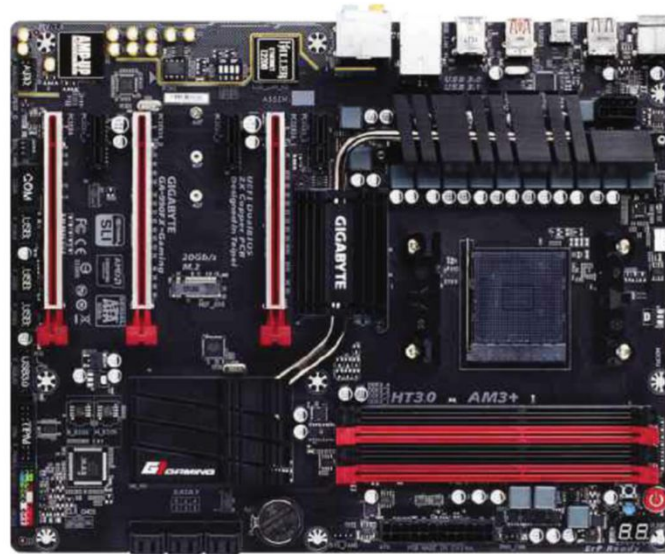
# Gigabyte GA-990FX-Gaming

## DETAILS

- Price: £135
- Manufacturer: Gigabyte
- Website: [goo.gl/kcAu7i](http://goo.gl/kcAu7i)
- Requirements: Socket AM3+ AMD processors, DDR3 memory



▲ The Gigabyte GA-990FX-Gaming motherboard is a great foundation for a performance system



▲ There's plenty of technology to enjoy and it looks good too

In direct competition to the MSI 990FXA Gaming, we have Gigabyte's GA-990FX-Gaming. This is a slightly younger motherboard than MSI's offering, having been released early this year, but one that still caters for performance and gaming system builders.

Naturally, it supports AMD AM3+ and AM3 processors, with four DDR3 DIMM slots, six SATA 6Gbps connectors and a single M.2 connector, two PCIe x16 slots, a single PCIe x16 slot running at x4 and three PCIe x1 slots.

The rear I/O backplate houses a single PS/2 keyboard and mouse port, Type-C USB 3.1 port, Type-A USB 3.1 port, two USB 3.0 ports, six USB 2.0 ports, gigabit 'Killer' Ethernet, optical S/PDIF out and a five-port audio block. Again, though, as with the MSI motherboard, there are no additional video ports for those who want to use AMD's built-in graphics.

As for design, the Gigabyte GA-990FX-Gaming certainly ticks all the right boxes. The black-and-red colour theme across the board looks good, as does the red LED along the audio section of the PCB. There's metal shielding, a single piece of stainless steel, reinforcing the PCIe connectors to offer better support for graphics cards while reducing any snagging

you'll get from placement and removal, as well as supporting the larger GPUs; it also helps reduce EMI.

There's plenty of room for multiple graphics cards, with ample space between each card's PCIe slots. There's also ample room for bigger CPU cooling solutions, although the more extreme heatsinks may interfere with the last DDR3 memory slot, so it's

best to take a few measurements before committing to a purchase.

The addition of the M.2 port is certainly points scored for the GA-990FX-Gaming. In fact, it's quite surprising that the MSI 990FXA missed out on M.2, since both boards are evenly priced. We assume that it's down to the younger age of the Gigabyte entry, because M.2 would have been a little

too expensive to include on the MSI motherboard at the time it was manufactured. However, M.2 is a great feature to have here and something a lot of system builders will opt for over some other motherboard elements.

An interesting feature of the GA-990FX-Gaming is an upgradeable OP-AMP (Operational Amplifier). This, according to the product guide, allows you to pull the OP chip out and replace it with another. To be fair, we didn't have anything to swap it out with and, if we're being honest, we're not sure we'd notice the difference. But for those who want an extra audio feature, the OP-AMP will certainly prove useful.

The Gigabyte GA-990FX-Gaming is a feature-rich motherboard that does an incredible job of ticking all the right performance builder and gamer boxes. It's priced at £135, the same as the MSI model, and it does offer a little more in terms of technology, but it's still a bit too niche for mainstream system builders.



## AMD Motherboard From £100

# ASRock Fatal1ty 990FX Killer

### DETAILS

- Price: £135
- Manufacturer: ASRock
- Website: [goo.gl/wqMDPK](http://goo.gl/wqMDPK)
- Requirements: Socket AM3+ AMD processors, DDR3 memory

The gaming competition for AMD 990FX chipsets isn't just between MSI and Gigabyte: ASRock released its Fatal1ty 990FX Killer nearly a year before the aforementioned manufacturers. But is it any good?

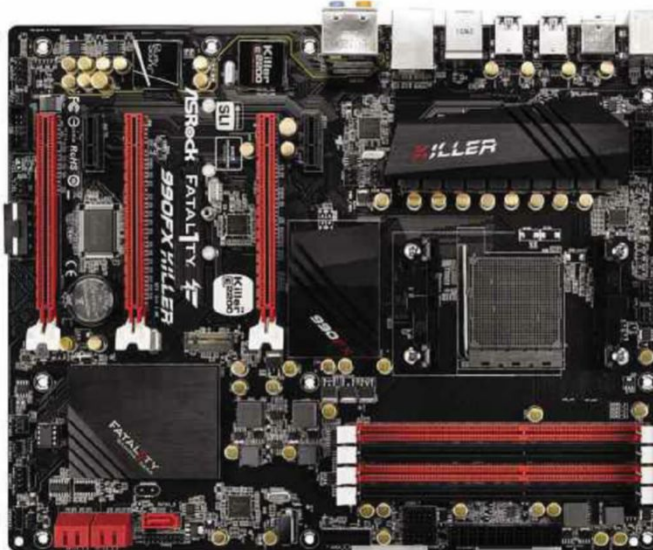
From its Fatal1ty gaming motherboard range, the 990FX Killer offers the system builder four DDR3 DIMM slots, five SATA 6Gbps ports, a single M.2 port, three PCIe 2.0 x16 slots and two PCIe x1 slots.

On the rear I/O backplate you'll find a two PS/2 mouse and keyboard ports, five USB 2.0 ports, a single USB 2.0 Fatal1ty mouse port, four USB 3.0 ports, one eSATA connector, gigabit Ethernet, optical S/PDIF out and a five-port audio block. Once again, you won't find any video output ports.

Naturally, the 990FX Killer is designed to accommodate multiple graphics cards, and due to its design there's enough room between the PCIe slots to fit the bigger cards without too much trouble or reduction in system airflow. The design of the motherboard is certainly good elsewhere, with a red-and-black colour theme along with Fatal1ty and Killer emblazoned on the various heatsinks. One thing we did notice is that the last memory



▲ The ASRock Fatal1ty 990FX Killer is another good performance motherboard



▲ However, there's nothing new to add to entice the buyer

slot is a little close to the CPU socket. While the average and stock cooler should cause too much of an issue, bigger and more aggressive CPU coolers may end up interfering with the memory module.

The addition of the M.2 port is beneficial, as with the Gigabyte 990FX and does the motherboard justice. In

case you're interested, by the way, the 'Killer' portion of the motherboard's name comes from the use of the Killer E2200 Ethernet port, whereas the Fatal1ty part is due to ASRock signing on the famous e-sports personality.

Other than that, there's very little left to add beyond the previously reviewed MSI

and Gigabyte motherboards. The ASRock Fatal1ty 990FX Killer's use of high-density power connectors, 15µ gold components and an additional SLI/CrossFire power connector are worth mentioning, to be fair. And as with the other motherboards in this guide, the 990FX Killer has solid caps and various degrees of humidity and electrical discharge protection.

The ASRock UEFI BIOS is very similar to that of MSI's version, in that it's easy to navigate and set a wealth of overclocking options. Again, though, as with the MSI example, it's not quite as friendly as the Gigabyte UEFI BIOS – from the point of view of someone who doesn't want extreme overclocking, just perhaps a small amount from time to time to keep up with the installed software and games.

The ASRock Fatal1ty 990FX Killer motherboard doesn't really bring anything new to the table that we haven't already seen. It's good and the same price as the MSI and Gigabyte models, so it's really down to a company preference in the end.



# Asus 970 PRO Gaming Aura

## DETAILS

- Price: £103
- Manufacturer: Asus
- Website: [goo.gl/FAOKwd](http://goo.gl/FAOKwd)
- Requirements: Socket AM3+ AMD processors, DDR3 memory

**D**ropping the price for our last entry and returning to Asus, we have its 970 PRO Gaming Aura. This is a fairly recent motherboard, released in May, using the older 970 chipset.

The 970 PRO Gaming Aura offers four DDR3 DIMM slots, six SATA 6Gbps ports, a single M.2 port, two PCIe x16 slots, two PCI 2.0 x1 slots and a pair of legacy PCI slots.

Rear I/O consists of a combo single PS/2 keyboard and mouse port, two USB 3.1 ports, eight USB 2.0 ports, gigabit Ethernet, optical S/PDIF out and a six-port audio block. As with most of the boards in this guide, there's no video output on the motherboard itself, so you're going to have to supply a separate graphics card.

The PRO Gaming side of the motherboard's title covers the SLI/CrossFire, SupremeFX shielded and high-performance audio. The Aura element is due to the under-lighting LED on the southbridge heatsink, where you can customise the colour and control scheme: static, breathing, strobing, colour cycle and even pulsing to the beat of any music played.

The LED lighting effects are a neat addition to the motherboard design, along with the now familiar black PCB and red components.



▲ The Asus 970 PRO Gaming Aura looks good and performs very well indeed



▲ What it may lack in some aspects it gains in a low price

Beyond the aesthetics there's plenty of room on the 970 PRO for a pair of large graphics cards, with lots of breathing room between the two slots, as well as room around the CPU socket for bigger than normal coolers.

On top of all that, there are also solid caps, highly durable components, stainless steel rear I/O backplate and all manner of electrical protection. Asus's UEFI BIOS, as mentioned with the A88X, is vastly improved

and offers the user plenty of scope to tweak the settings. It's exactly the same BIOS as the A88X, so there's nothing really new to add here other than the additional calibration of the LED effects from the Aura element of the motherboard's name.

Of course, there's overclocking available, with the BIOS offering an easier than normal access to the various settings, profiles and so on for those who don't want to push the CPU clock envelope too far.

The main feature of the Asus 970 PRO Gaming Aura is to provide the system builder with a good foundation, while offering something a little more alluring, in the case of the LEDs. Asus has done a good job of hitting that nail on the head here, with the price of the 970 PRO being just £103.

It'd be nice to see a video output port included, but for just over £100, it's not too unrealistic to consider a couple of AMD's new RX-GPUs to complement this already good motherboard.



# Linux: From A-to-Z

## David Briddock continues his journey through Linux

This week's topics, based around the letter N, are networking, network-attached storage, non-uniform memory access, and the 'nice' command.

### Networking

Early mainframe and mini computers stood in complete isolation, accessed only via 'dumb' user terminals with no processing power of their own. Today's gigantic data centres are packed with tens of thousands of inter-networked processors, the majority of which are running Linux.

Networking is built into the very fabric of Linux with a number of terminal commands that date back to the early days of UNIX. Examples include the secure remote login command 'telnet', the secure shell command 'ssh' and the file transfer program 'ftp'.

## “ NAS servers and RAID containers are critical components of any large data centre ”

There are many networking protocols, such as the Networking File System (NFS), but one of the reasons for Linux's success as a server is its ability to seamlessly connect to just about any other operating system. For example, the GNU-licensed Samba software provides native-like Microsoft Windows file and print services as well as Active Directory support.

### NAS

A network-attached storage (NAS) device is a dedicated data storage server accessible by any computer on the same network. Open source examples include FreeNAS ([freenas.org](http://freenas.org)) and NAS4Free ([nas4free.org](http://nas4free.org)). Each NAS server typically contains a number of storage elements, arranged as a set of logically redundant containers known as RAID, where data is duplicated across multiple elements.

Over the last few decades, NAS servers and RAID containers have become critical components of any large data centre. They facilitate speedy data access, ease administration, and simplify configuration. The drives themselves often have specialised RAID firmware and enhanced reliability features like vibration tolerance.

Most importantly, NAS servers ensure that if a processor unit fails another processor can step in to utilise the same storage device. Plus, the RAID arrangement means that if a storage unit fails processing can continue on another storage device containing the same data.

### NUMA

Specifically designed to support multiprocessing systems, Non-Uniform Memory Access (NUMA) is a computer memory architecture where access time depends on the memory location relative to the processor. With a NUMA implementation, each processor can access to its own local memory, which ends up being much faster than processor-shared memory or processor independent memory.

NUMA has been supported in some form or other by the Linux kernel since version 2.5. While version 3.8 introduced a new, re-coded foundation that enabled developers to define more efficient NUMA policies in subsequent kernel releases. Incidentally, Microsoft introduced NUMA support in Windows 7 and Windows Server 2008.

### Nice Command

Linux is a true multitasking operating system, meaning at any particular moment there are a large number of process threads competing for system resources. Despite today's powerful multi-core processor chips, this can mean things run a little slowly from time to time.

One way to help the situation when firing off your own jobs, especially ones that might take a while to run, is to use the 'nice' command.

With 'nice', you execute a process at a lower priority than the default ten. This means it will take a little longer to finish, but not slow down other more important processes. For example, if you're sorting a large file but not in a hurry to see the result you can prefix the 'sort' command with 'nice' and set a priority to, say, five. `mm`



▲ NAS hardware



# Component Watch

**With screens this expensive, every penny saved is well worth it**

About six months ago we took a look – no pun intended – at the best monitors on the market. Admittedly, not everyone wants to drop £500+ on a screen, but if you're the sort of person who wants an all-singing, all-dancing monitor and are wondering what a difference that amount of time can make to the price of the best (even if, admittedly, they're not the best any longer) then this week's Component Watch has you covered with a selection of deals on these hand-picked high-end monitors.

**Deal 1: Philips BDM4350UC**  
**RRP: £599.99 / Deal Price: £560.02**

At 43" this Philips monitor is one of the largest on the market, and its 4K, IPS panel is more than up to the task. A 5ms response time is lower than most, but there are built-in 7W speakers and three USB 3.0 ports (one fast-charging) alongside the HDMI and dual DisplayPort inputs and a VESA-compatible mount. It's clearly designed to work as a TV and a monitor, and that makes it a great choice for HTPCs and media boxes.



**Where to get it:** Box - [bit.ly/2fRpDm1](http://bit.ly/2fRpDm1)

**Deal 2: Asus PG27AQ**  
**RRP: £835.98 / Deal Price: £710.92**

This 27" monitor has a 4K resolution (3840 x 2160), with a height-adjustable stand, HDMI and DisplayPort inputs and 4ms response time on its IPS panel. It was voted the best 4K monitor of 2015, and you get a free copy of Doom if you buy before the end of August, so there's plenty to like here! Designed for gamers, it has a special bright/high-contrast gaming mode with crosshair overlays, an FPS counter and a time available within the monitor's HUD. And low-blue-light support for night gaming, alongside two 2W speakers.



**Where to get it:** More Computers - [bit.ly/2gJ5ehx](http://bit.ly/2gJ5ehx)

**Deal 3: BenQ BL3201PT**  
**RRP: £749.99 / Deal Price: £714.35**

This 32" 4K (3840 x 2160) monitor has a 4ms response time, HDMI and DisplayPort inputs and a VESA mount, but what really makes it worth the money are the 10-bit display panel and CAD/CAM mode. Designed for professional and high-fidelity use, it's ideal for video editors and artists, with picture-in-picture and picture-by-picture support. Two built-in 5W speakers, a line-in and headphone/line-out complete the package.



**Where to get it:** Ballicom International - [bit.ly/2g7dKpl](http://bit.ly/2g7dKpl)

**Deal 4: Samsung U32E850R**  
**RRP: £949.97 / Deal Price: £729.95**

Samsung's name is always a good one, and that goes double for their top-class monitors. This 4K 32" screen has a resolution of 3840 x 2160, a 4ms response time and FreeSync technology to minimise latency and tearing. Picture-in-picture, picture-by-picture, gaming and low-light modes are just the start of its many features. It has dual HDMI-in, DisplayPort, mini DisplayPort, and four USB 3.0 ports with fast-charge support. There are no speakers, but you can buy an optional soundbar that mounts seamlessly on the rear of the monitor for high-quality sound. Impressive.



**Where to get it:** John Lewis - [bit.ly/2fLWRQg](http://bit.ly/2fLWRQg)

**Deal 5: Acer Predator XB321HK**  
**RRP: £899.99 / Deal Price: £759.99**

The Acer Predator is a super high-end 32" gaming monitor with G-Sync support, a 4K/UHD screen and height-adjustable stand. 4ms response time, HDMI and DisplayPort connectivity and a USB 3.0 port make it a solid choice, but the GameView mode enhances blacks and colours for ideal gaming performance. It's light on features, but if you want all your money to go into the screen this is the model to choose!



**Where to get it:** Ebuyer - [bit.ly/2fRmNwZ](http://bit.ly/2fRmNwZ)

# The Things Killing Your PC

**Your computer is slowly dying, throttled by malware, bloatware, old components and dirt. But it doesn't have to be that way: our guide shows you how to reverse the ageing process and make your PC run like new again**

**N**o matter how advanced computers get, there's one inevitability: they all get slower over time. When the issues build up, a slow PC can be infuriating to use and, in the worst cases we've seen, even cause the computer to be abandoned.

In most cases, the slowdown is not because of old hardware not being able to cope, but rather the cumulative effect of lots of minor things going wrong. These can be as simple as old software taking up resources on startup or dust building up inside the case, making your computer hotter and thus causing the CPU to slow down to protect itself, to hidden malware running rampant.

The good news is that all these problems can be fixed. So, before you decide your old computer has had it and it's time to upgrade,

you should follow our instructions over the next 10 pages as we show you how to reinvigorate your PC.

Our in-depth step-by-step instructions will help you identify and fix the 21 most common culprits for a slow computer, and many of the not-so-common ones, too. You should think of this feature as a regular maintenance guide: repeat the steps every few months and you'll ensure that your computer always stays in tip-top condition.

Even if it is time to make a new purchase, these instructions should still prove invaluable, as you can give your old computer a massive tweak to make it usable for someone else; perhaps it can go to a family member or even be donated to charity.

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## Hidden Malware

**Not all malware can be detected by your AV software. Here we show you how to find the bad stuff you probably don't even know is there**

**T**he amount of malware in the wild is truly terrifying. In 2015 alone, Kaspersky detected that 34.2% of users' computers were subject to a web attack. That statistic only takes into account the PCs protected by Kaspersky Internet Security and where malware was detected and blocked. By definition, hidden malware won't even feature on that list, so there's a good chance you, a friend or a family member have fallen prey to a silent PC killer.

The truth is that this kind of attack doesn't affect just the naive computer user but experts, too, and we're all equally vulnerable to this kind of threat.

### **Doesn't security software stop this?**

In a perfect world, all malware would be stopped by your security software, but we don't live in a perfect world. That's not to say you shouldn't bother with security software: it will protect you from

the majority of threats. You should run high-quality protection, such as Kaspersky Internet Security, which is Shopper's security suite of choice.

However, cybercriminals are always coming up with new threats that security companies have yet to detect. Viruses, Trojans, worms, ransomware and other types of malware are constantly evolving, and new threats can stay one step ahead of the protection.

On top of that, there are threats that fall into grey areas. For example, when you install some free software you'll get a message box asking if you want to install another bit of software, such as a browser toolbar. Often these dialogue boxes are pre-configured for your agreement, with many of us installing additional software by mistake. These additional bits of software can often include adware or other features that we

consider to be malicious. As the software has to be agreed to be installed, most security software won't pick them up and remove them, even if they're resource hogs.

It doesn't even have to be software that you've installed. Lenovo was caught out when it came to light in 2015 that it had been pre-installing the Superfish adware on all its computers. This software injected adverts into web pages and made secure connections insecure, yet it was undetected and untouched by security software.

### **Find Hidden Malware Investigate mystery processes**

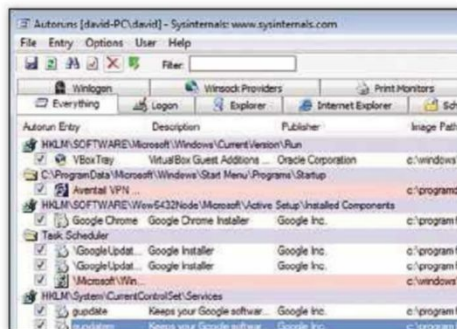
There are many obvious signs that your PC is infected, such as if it crashes all the time or if your browser homepage has changed and you can't change it back. The kind of malware that we want to hunt down doesn't do that. Instead, it hides its files and

its processes don't turn up in Task Manager.

As clever as the malware thinks it is, the fact is that there has to be an instruction somewhere that tells it to start up with your computer. To find this, we recommend using Autoruns, which scours your entire PC to discover startup applications. We'll use it on page 102 to clear down unwanted applications, but we can also use it now to find and detect malware.

Download Autoruns (tinyurl.com/DownloadAutoruns) and extract the Zip file to your computer. Double-click autoruns.exe to run the software (there's no need to install it on your PC); alternatively, right-click and select Run as administrator to get more thorough results. You'll need to wait a few seconds while Autoruns discovers and lists every process and application that starts with your PC, including Registry entries, browser extensions and drivers.

Even on a relatively new and clean computer, the list of startup items can look intimidating, so we need to narrow down the list a little. To do this, select Hide Empty Locations and Hide Microsoft Entries from the Options menu. You'll be left with a list of third-party entries. Scroll through this list to spot any entries that you don't recognise.



▲ **Autoruns will find all the applications that automatically start with your PC**

When you see an unknown item, right-click it and select Search Online. This will open your browser with a Google search



▲ **File.net tells you if a process is safe or not**

for the name of the process. You'll see various search results. The ones to look out for are links to file.net, which tells if you a file is safe; processlibrary.com, which tells you what a process is and why it's running; and shouldblockit.com, which tells if you if you should kill a process.

### Find suspicious hidden processes

Autoruns also has the ability to detect malicious processes thanks to its integration with the file-checking database, VirusTotal.

Annoyingly, the service isn't enabled by default. To get it working, right-click any entry in the Autoruns list and select Check VirusTotal. You'll see a pop-up dialogue box telling you that you need to agree to the terms of service to enable VirusTotal; agree, and your browser will load the terms and conditions. You can just close this page down, as you've enabled the VirusTotal features.

At the moment, you'll have scanned only the one file. To check your entire list, go back to Autoruns and select Options, Scan Options. Select the 'Check VirusTotal.com' and 'Submit Unknown Images' tickboxes and click Rescan.

Autoruns will now run through the entire list of processes again, but will submit every one to VirusScan. This is all done over the internet, so it can take a few minutes for the VirusTotal scores to appear.

When VirusTotal has finished, each process will be given a score out of a maximum. The maximum value can change between 53 and 57 in our experience, and is down to the way that VirusTotal works: it checks 57 sources to see if a file is listed as suspicious. The more databases the file is in, the higher the maximum score; the higher the VirusTotal score, the higher the chance that a file is malicious. It's not unusual to find a few files on your computer that score one or two in total, but the odds are that these are safe.

For more information, just click the score next to a process and you'll be taken to the virustotal.com page, which lists information about that particular bit of software.

### Stopping malware from running

To prevent a process starting automatically, just remove its tick from Autoruns and that's it. We recommend removing anything that has a high VirusTotal score, or which you discovered was malicious when using the internet search option. Now reboot your computer and re-run the steps above to see if the malware has gone for good; in some cases, the malware finds a way to come back, in which case you'll need to

follow the information below.

### Root out rootkits your AV can't see

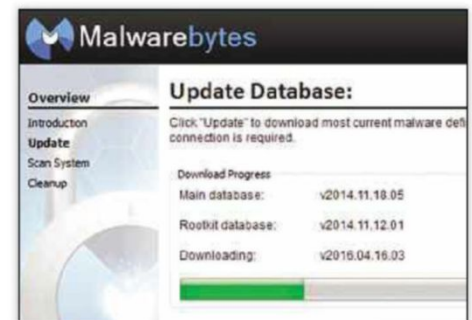
Every operating system has a restricted root level access, which is used to perform administrator tasks that should be hidden from the user. This is typically low-level stuff, such as dealing directly with drivers and hardware. Rootkit malware takes advantage of this by installing itself at a lower level in the OS, effectively cloaking it from detection with normal tools and even anti-virus software.

The problem with this kind of malicious software is that it can be used to steal data or even to give hackers remote control of it, so they can use it for nefarious purposes, such as sending spam email.

To get rid of a rootkit, you need software that can detect it. Despite the 'Beta' in the name, the free Malwarebytes Anti-Rootkit Beta (tinyurl.com/AntiRootkitBeta) is ideal, as it's extremely easy to use.

Download the software and run it to start the extraction process. Select which folder you want to extract the files to (the Desktop is the default option) and click OK. When the extraction has completed, the software will run automatically.

Click Next and then click the Update button to get the latest malware definitions. Click Next when done. Finally, click Scan and let Malwarebytes scan your entire computer.



▲ **You need to download the latest malware definitions to discover the latest rootkits**

It's a thorough scan, so will take a while to do properly. Our advice is to walk away from your computer while the scan continues. Hopefully, when you come back you'll see the message, "Scan Finished: No malware found!". If the scan does detect a rootkit, click the Cleanup button and restart your computer to destroy it. When your PC loads Windows again, re-run Malwarebytes to see if the rootkit has truly gone; you may need to repeat the entire cycle a number of times.

### Remove stubborn malware

As good as it is, Malwarebytes' Anti-Rootkit

can't defeat all infections, so you may need to up the ante with GMER. It's not a very friendly app, but it's recommended by professionals.

Go to the GMER website ([www.gmer.net](http://www.gmer.net)) and click the Download EXE button. This will download a file with seemingly random letters and numbers (at the time of writing the file was called 1yiztw69.exe, but this changes regularly). When it's downloaded the file, run the software. Click the Scan button to start searching your computer.

This deep scan takes a while and uses a lot of system resources, so we recommend walking away from your computer while it's doing it. If you get any problems, a message will pop up that says, "Warning!!". Click OK to remove the troublesome file, restart your computer and start the scan all over again. Repeat as



▲ AdwCleaner is simple to use, and will remove a lot of malicious software

many times as required.

### Adware and PUPs

As well as malware, there are adware and other potentially unwanted programs (PUPs). Adware can change system settings and insert adverts into web pages, and can be hard to remove; other PUPs are often installed by accident when you install free software and can have a negative impact on system performance.

To find and remove adware, run the free portable program AdwCleaner ([tinyurl.com/DownloadAdwCleaner](http://tinyurl.com/DownloadAdwCleaner)). Run the downloaded application (it doesn't need installing). Click 'I agree' on the first dialogue box, then click the Scan button to search your PC for adware, Trojans, browser hijackers and more. If AdwCleaner finds anything malicious, click the Clean button to remove the software. Reboot your computer and re-run the scan to be sure that everything has gone.

Even this won't find everything, though, so run Malwarebytes Anti-Malware Free ([tinyurl.com/AntiMalwareFreeDownload](http://tinyurl.com/AntiMalwareFreeDownload)). Run the file you downloaded to install the software. When you click Finish at the end of the installation, Anti-Malware will start automatically. Click the Scan button to start scanning your computer. If it detects any malware, you can click 'Review Detected Items' to investigate the



▲ Anti-Malware Free will clear up anything other software might have missed

infection while the scan is still running. You can then remove the selected items.

### Fix hidden malware damage

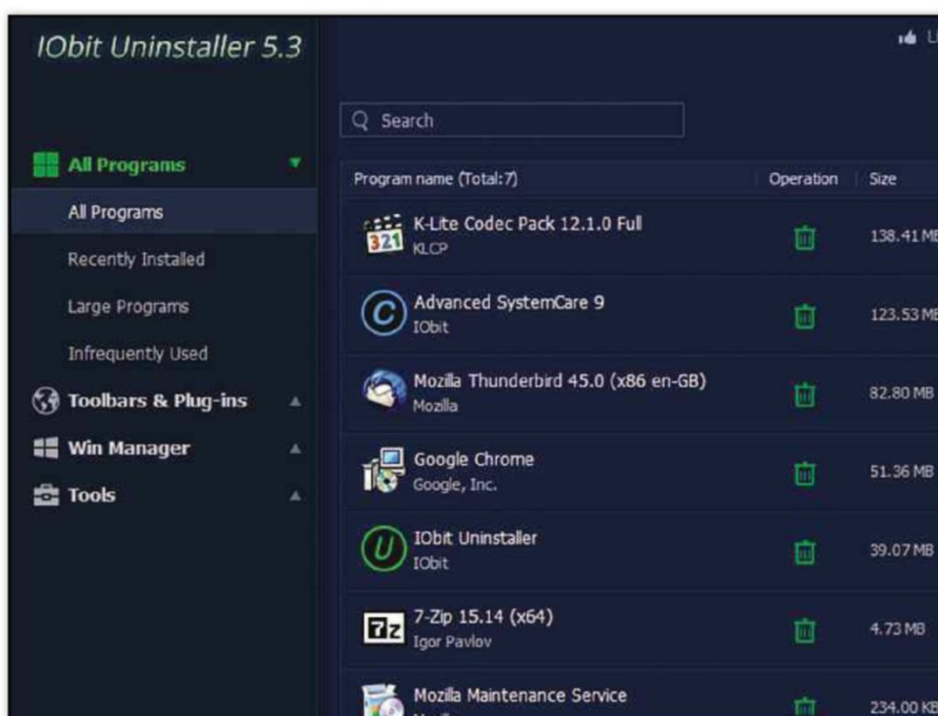
Malware can cause a lot of damage that won't necessarily be undone when you remove the offending software. As such, clearing up at the end of the clean-up process is vital. If you've downloaded Malwarebytes' Anti-Rootkit Beta then you've already got the FixDamage application. To find this, go to the Plugins folder in the mbar folder. This will be on your desktop if you left the default options alone; otherwise, it will be where you chose to install it.

Run FixDamage and it will start a new Command Line window. Type 'Y' and FixDamage will restore Windows' main settings back to their defaults.

## Bloatware And Unwanted Applications

**From the junk that was installed when you got your PC to the free utilities you've tried and forgotten about, old software can hog resources and really drag your computer down. Here's how to remove it**

Installed Software can be among the worst offenders when it comes to slowing down your PC. Whether it's the cumulative effect of lots of new applications being installed and removed, or simply just all the bloated software that manufacturers see fit to install on our new computers, from free trials to 'helpful' utilities, software can be a real killer. Even worse, some software is either dangerous and open to hackers, or installs adware or other junk with it. They're the main reasons why you should uninstall the top five



bits of rubbish software (see box, opposite). As such, it makes sense to be harsh in the treatment, weeding out old junk completely.

For the software you want to keep, there's a secondary threat: start-up items. These launch automatically with your computer, often putting icons into the Windows Notification Area (bottom-right, near the clock). Everything running in here takes up precious system resources, so preventing these applications from running will make your computer run faster. We'll show you how to fix everything.

“ The difficulty is that in the midst of the annoying software, there are genuinely useful programs you shouldn't remove ”

Most software that you don't want can easily be removed from the Control Panel, but the default Windows options don't always get rid of everything. Instead, we recommend using the free IObit Uninstaller ([tinyurl.com/IOBitUninstallerDownload](http://tinyurl.com/IOBitUninstallerDownload)). This application will also clear out the hidden junk left behind by applications.

## Remove unwanted applications

Go to the All Programs area of IObit Uninstaller. When you see an application you want to remove, click the green rubbish bin icon. This will start the normal uninstall routine, but when you're done you'll be asked if you want to run the Powerful Scan, which will track down junk files and remove them.

## Branded services and utilities

PC manufacturers often load up a computer with dozens of additional utilities. Some are designed to make using your computer easier, others are designed to get you to sign up for premium services, such as cloud storage, with the manufacturer taking their cut. Other bits of software are slightly more nefarious, such as web toolbars that change your search engine and homepage (again, the PC manufacturer gets paid for this).

The difficulty here is that in the midst of the annoying software, there are genuinely useful programs that

you shouldn't remove. Scroll through the list in IObit Uninstaller and leave any software created by your PC's manufacturer, at least for now. It should be safe to remove all other applications from your computer, once you've read our advice on Drivers below.

It's better to remove too little when you start. As you use your computer more and more, note down the name of any software that's annoying and displays too many pop-up messages. Once you've got a good list together you can find this software and uninstall it, regardless of who the publisher is.

## Drivers

Driver software is genuinely very useful and will make your computer work properly, so don't remove any of this. The most common drivers are branded Realtek, AMD, Nvidia, Intel, Qualcomm and Broadcom, but there may be others depending on the model of your computer.

Also look out for device-specific drivers, such as ones for your keyboard, which will make sure that all the shortcut buttons are working properly. These include device-specific button mappings (such as Alt-key commands) and audio software that might provide enhancements to sound designed for your device's speakers.

Finally, look out for any manufacturer-provided update software. This will download the latest driver and software updates for your computer automatically.

## Links and uninstalled software

You'll often find that a new computer has various bookmarks, desktop shortcuts and trial software installers on it. These generally can't cause any harm, but they're annoying and eat up disk space. Feel free to delete anything like this that you find.

## Security software

Security software is one of the biggest culprits of bloatware, as computer manufacturers can make good money if you convert the trial version of the

software into a paid-for subscription. The warning in that statement is that manufacturers care more about how much money they can make than they do about giving you the best protection.

We recommend uninstalling all security software that you're not paying for or haven't installed on purpose. Once you're done, install proper security software, such as Kaspersky Internet Security.

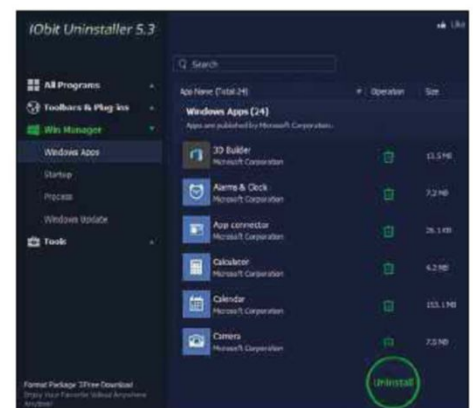
## Old software

You can see when you installed software, so you can remove applications you no longer use. Even better, if you click Infrequently Use in IObit Uninstaller, you can remove software that you don't use very often.

## Modern UI/Start screen apps

If you're a regular visitor to Windows 8.1's controversial Modern UI Start screen or the improved Windows 10 Start menu, you'll probably find several applications here installed by your computer's manufacturer. These tend not to be so annoying (they can't launch automatically, or interfere with the rest of your computer, for example), but they do eat up disk space.

They don't appear in the traditional Add/Remove Programs or Programs and Features windows and instead can be removed from within the Start screen by right-clicking the offending item and selecting Uninstall. Alternatively, you can use IObit Uninstaller's Win Manager, Windows Apps section to remove the software that you don't want. This way has the advantage that you can see which applications are the largest.

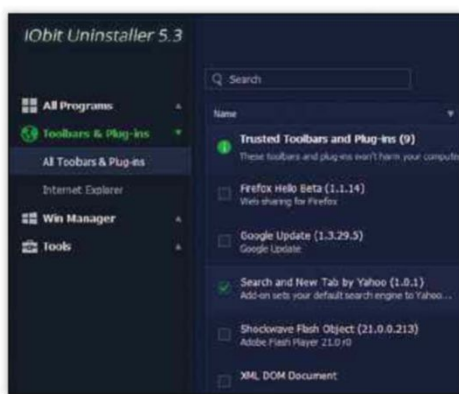


## Toolbars

Browser toolbars are some of the worst offenders. They're often resource hungry, don't do anything useful and

sometimes come with nasty payloads. We recommend that you uninstall all of them.

Most proper toolbars from reputable sources can be removed via All Programs in IOBit Uninstaller. However, you can also click the Toolbars & Plug-ins option to view all installed Toolbars. This list is sorted into toolbars that are safe and those that aren't. Remove all the unsafe toolbars by selecting them and then hitting Uninstall. You can clear out toolbars in the safe list, but only pick the ones that you recognise, as there are some helpful things in there, too, such as Google Update, which keeps Chrome up to date.



## Startup Applications

Some of the software that you do want to keep can be really annoying and start when your computer does, hogging resources without need. If this is the case, the best thing to do is to clear them out. Autoruns can be useful for detecting unwanted applications (see page 100), but for legitimate software, there are better ways.

For Windows 10 users start the Task Manager (press Ctrl-Shift-Esc) and then click Start-up. You can right-click any application that you don't want to start and select Disable. Reboot your computer when you're done. If you want to re-enable a bit of software, follow the previous instructions and select Enable.



For Windows 8 and below, you have to press Windows-R, type 'msconfig' and press Run. This will load the System

Configuration utility. Click on the Startup tab and you'll see a list of applications that start with your computer. Remove the tick from the box for the applications that you don't want to run and click OK. Restart your computer. You can reverse these instructions to re-enable an application if you've accidentally disabled something useful.

Not all startup applications are so easy to deal with, as some launch as services. To stop these in Windows 7, 8 and 10, start the System Configuration utility as above. Click Services and then click the Manufacturer tab to sort by manufacturer. To prevent a service starting at startup, remove the tick from its box. Do not stop any Microsoft service (you can hide these by selecting Hide all Microsoft services). We recommend leaving any service from a manufacturer that has anything to do with hardware (your PC's manufacturer, AMD or Nvidia, for example). Also, leave any service alone that is from the manufacturer of your security software. Click OK when you're done and restart your computer. If you've stopped a useful service by mistake, you can reverse these instructions to re-enable the affected service.

## Free Software

Free software can be just as bad as the rubbish that PC manufacturers put on your computer, with many applications also installing additional toolbars and bits of bloatware. For that reason, when it comes to installing free software we recommend using Ninite (ninite.com).

This clever utility automatically downloads and installs spyware-free software: just tick the software you want and hit the download button. Finally, once you've cleaned out your computer and if you haven't already done so, follow our anti-malware guide on page 100.



## Get Rid! Software You Should Uninstall Now



### Flash

Adobe's Flash is a massive target for hackers and it's also a resource hog, slowing down a computer when you visit a Flash-heavy website.

The good news is that you don't need it any more, as the majority of good websites have switched to alternative technologies. YouTube, for example, doesn't need Flash for you to play videos.



### Java

Java is another old web technology. Again, it's often a target for hackers and can be insecure. Updates to the software don't remove old versions either. Even Minecraft has moved to a version that doesn't need Java, so ditch this software now, using IOBit Uninstaller to remove the old versions, too.



### Thunderbird

Once one of the best email clients available, Thunderbird has stopped being updated, making it a target for hackers. If you have this software installed, ditch it now and either switch to a web client or the excellent MailBird (available from [www.getmailbird.com](http://www.getmailbird.com)).



### CamStudio

This free screen-recording software usually has an installer that's packed with adware and other unwanted applications. Remove it using IOBit Uninstaller, then follow our malware guide on page 100 to make sure you've got rid of everything bad.



### DVDVideoSoft

DVDVideoSoft makes utilities, such as screen recorders and YouTube downloaders, but its software installers come with lots of nasty hidden extras. You should avoid anything by this manufacturer and remove all its software using IOBit Uninstaller and our malware guide on page 100.

# Bloated Windows operating system

Over time, Windows can become so bloated and messed up that the only thing to do is to start again from scratch. Here's how you do it

The more you add and install applications and use Windows, the more orphaned files you get, the more startup applications you have hogging resources, and the more bloated your PC gets. Sometimes it makes more sense to start again. If you're running Windows 7 you can only do this by doing a clean install. If you have Windows 8 or Windows 10, it's better news: you can restore your computer from inside Windows. Here's how to do it.

## Windows 8

While it's generally very easy to restore Windows 8, the utility can run into problems if you've upgraded to Windows 8.1. This is because the upgrade doesn't refresh the files that Windows needs to restore factory default settings – annoying, huh? Fortunately, Microsoft has made it fairly straightforward to download and create your own Windows 8 or Windows 8.1 installation discs, so we can show you how to get around this.

### Start the restore process

Go to the Start screen and type Remove to bring up the search box. In the results that appear, you'll see an option called 'Remove everything and reinstall Windows'. Click this to start the clean-up utility, which you'll use to flash your computer back to factory defaults.

The Windows 8 app that starts gives you two cleaning options. The first is a refresh, which will leave your personal files alone, but clears out your applications and settings; the second option removes everything and

gives you a clean installation of Windows. This is the choice to make if you're getting rid of your PC, or it's so hopelessly slow and cluttered that you want to go back to day zero with it. Both work in roughly the same way, so select the option that applies to you; the rest of this guide follows the 'Remove everything and reinstall Windows' option.

### Fix the 'Some files are missing' error

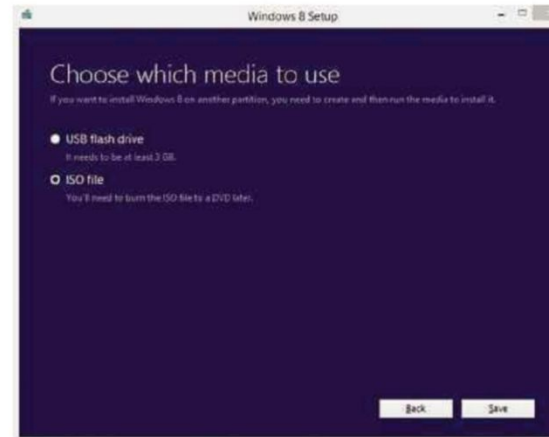
If you upgraded from Windows 8 to 8.1, you may find that you get an error message telling you that "Some files are missing". It tells you to insert your Windows installation disc, which you mostly likely don't have.

Fortunately, there's a way round this problem. Download the Windows 8 Upgrade tool ([tinyurl.com/Win8ISODownload](http://tinyurl.com/Win8ISODownload)). When you run the file select the ISO file option to download the Windows 8.1 disc image to your hard disk. Next, find the ISO file, right-click it and select Mount. Now, re-run the Remove everything utility and you'll no longer get the error message.

If this doesn't work, it's because the app doesn't realise you have a Windows disc installed. This is easy to fix: reboot your PC, mount the ISO file that you downloaded and then run the Remove everything tool.

### Reset your computer

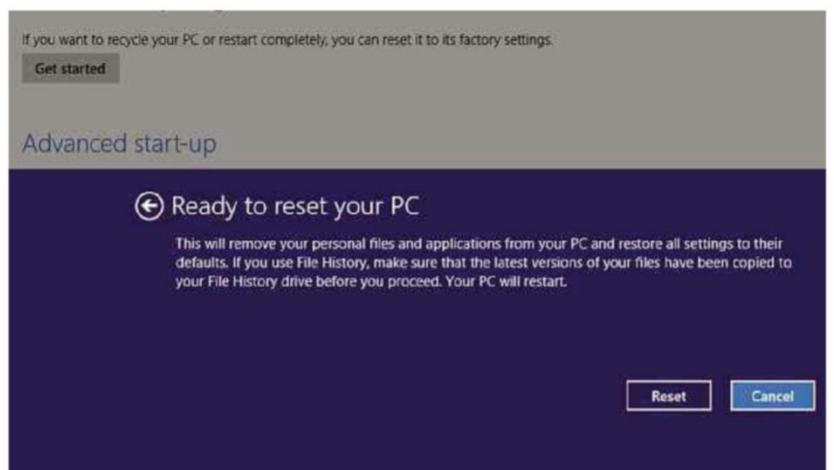
You'll now see a message telling you that all your files and applications will be removed and that your PC's settings will be restored to their defaults. Click Next to continue. If you have more than one drive in your computer, you'll be asked if you want to clean only the drive where Windows is installed or all drives. Select the one that



applies to you. If you only have one drive, you'll go straight to the next option.

You'll now see two choices: 'Just remove my files', which deletes your files but not securely; and 'Clean the drive fully', which performs a full secure wipe. The latter option takes longer, but is the right choice if you're going to be selling your computer or throwing it away, as it stops anyone from recovering your private data. With the first option your files are just marked as deleted, but still exist and can be accessed on the hard disk by anyone using recovery software.

This is your last chance before your computer is wiped. Windows will tell you what you're going to do; if you're sure you're ready, click Reset and your computer will reboot and reset itself back to its factory defaults, ready for you to start from scratch or pass on to another person. If you're keeping your computer, you'll need to reinstall all your applications and any files you need from a backup.



# Windows 10

We'll show you two methods for restoring your PC: the first uses the built-in Windows 10 tool, which gives you a clean install; the second lets you take a system image, so you can restore your PC back to this point in time at any point in the future.

## METHOD 1 Factory reset

Click the Start menu and type 'reset'. Click 'Reset this PC' and the Reset window will open. If you're encountering problems you didn't have on Windows 7, 8 or 8.1 and you upgraded to Windows 10 less than a month ago, you can go back to your old OS. If you want to stay on Windows 10, click 'Get started' under 'Reset this PC'.



You'll see a dialogue box that gives you three choices. Note that if you use any of these options (bar the last one), you'll lose

the ability to go back to Windows 7, 8 or 8.1 in future. We've explained what each option does below so you can choose the right one.



### Keep my files

This setting will uninstall all the programs on your PC but won't touch other files such as your documents and settings. It will uninstall programs you downloaded from the internet and installed from discs, but when you return, any apps you've installed from the Windows Store will be reinstalled. This is a handy way to refresh your computer if it's

not running properly and you don't want the hassle of having to restore your files.

### Remove everything

Remove everything does the same as above, but it also removes all your files. This is the best way to freshen up your PC without going back to your old operating system and acts like a clean install of Windows 10. If your computer shipped with Windows 10, this option keeps programs that came installed with your PC, so you won't get a completely clean slate.

### Restore factory settings

This option is similar to Remove everything, but if your PC didn't come with Windows 10, you'll be downgraded back to Windows 8 or 8.1. You'll lose all programs, files and settings, but programs that came with your PC will remain.

## METHOD 2 Use a system image

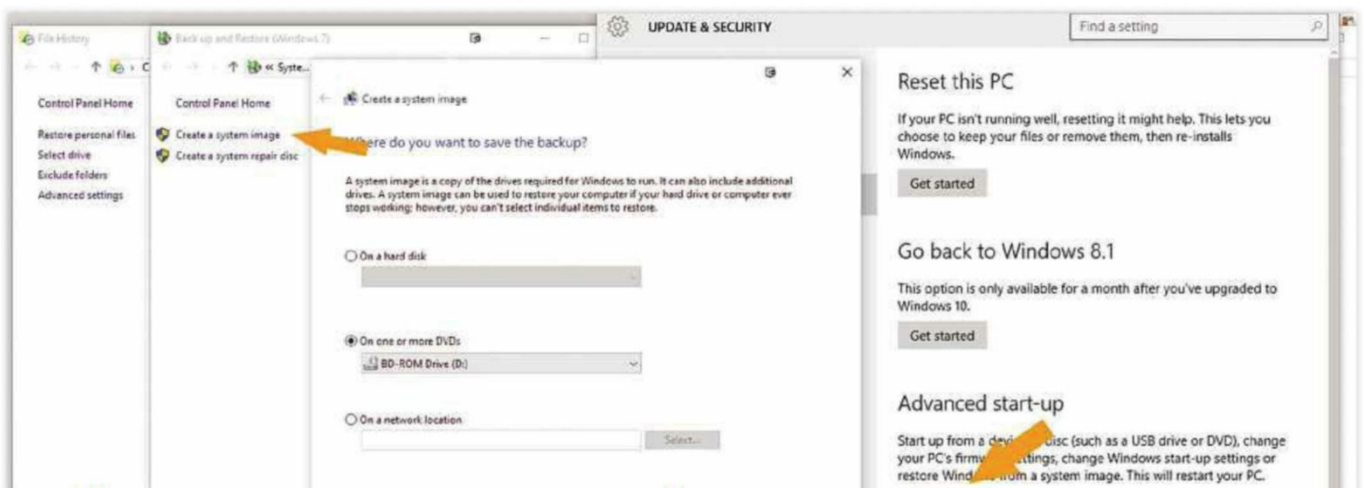
If you don't want to reset Windows at this time but think you might want to in the future, it's worth creating a backup of your system now in case it develops a fault in the future. This takes a copy of your files, settings and applications at this specific point in time. If you've just got your computer the way you want it, this is a handy way of being able to get back to that point at any time in the future.

In the Start menu, type 'backup'. Click File History and wait for it to load. Click 'System image backup' at the bottom, then 'Create a system image' from the menu on the left. You'll be given a choice of where to place this system image: on a hard disk, optical drive or network. When you've selected a drive, click Next and then Start backup.

To use your system image, return to the 'Reset this PC' menu we were using

before. This time, click Restart now under Advanced start-up. When your PC restarts, you'll be given the option to reinstall Windows from the system image you created. This is probably the best option, as it puts Windows into a state you were happy with at one point in time.

This option will remove any files created after the system image was made, so make sure you back up your PC first.





# Heat And Dust

**It's not just digital junk you need to bin – all the dirt that builds up inside the case also cuts efficiency**

IT'S COMMON TO give your house a spring-clean, and you should devote the same love and attention to your PC – you may be surprised by how much dust is dragged inside by the case fans. Dirt you can't see may not seem a problem, but it can build up and clog the fans, making them less efficient at cooling. Dust also acts as an insulator, so your PC will run hotter and may even crash as a result.

So grab a pair of Marigolds, delve into your case and follow these easy steps to clean it out. By the time you've finished, your PC will be sparkling and, more importantly, running cooler and more efficiently.

## Case lift

Cleaning the outside of the case with foam cleaner is simple, but don't spray the foam on the front or rear of your PC, as it could get into your drives, power supply and ports. Spray the foam on a cloth and apply it to the front of the case, including the optical and floppy drives.

The rear of the case will be mainly metal, but rub a foam-covered cloth over the parts of the case that wrap round the rear of your PC. Leave the foam for 15 minutes, then use a separate cloth to wipe the case clean.

## Fresh air

Cleaning the inside of your PC is the biggest challenge, as dust can build up in hidden areas. Remove the side of the PC and any expansion cards from the motherboard. If the PC is particularly filthy, you may have

to remove the motherboard, hard disk and optical drives too.

Don't vacuum the motherboard, as it has too many sensitive components. Instead, spray an air duster over the motherboard – starting at the top – so the dust collects in the base of the case, or in a bin if you've removed the motherboard from the case.

Use a vacuum cleaner to remove the worst of the dust from the bottom of the case and from the processor's heatsink, fan and case fans. Finally, use plastic safe wipes to remove any dust from the cables inside your case.

## Blown away

Dust on expansion cards can be removed with the air duster. Make sure you've removed all the dust wedged beneath components, such as capacitors, and check the heatsink and fan on your graphics card are free from dust. Blow the air duster into your expansion cards' ports and sockets for extra cleaning power.

## Paint job

Removing dust helps, but there are other things you can do to help prevent overheating. There's a thin layer of thermal compound between the processor and the heatsink, which smooths over any imperfections in the two metal surfaces and makes sure that heat from your processor is dissipated efficiently. Eventually, thermal compound dries out and reduces the efficiency of your cooling, so it needs replacing from time to time. This is a simple job that can have a dramatic effect.

## shopping list

To follow our simple instructions for cleaning up your computer, you'll need these products from [www.maplin.co.uk](http://www.maplin.co.uk):

1 can of computer air duster	£5
1 can of computer foam cleaner	£4
1 pot of plastic safe wipes	£3
1 packet of cable ties	£3
1 pot of silver-thermal compound	£3
1 bottle of isopropyl alcohol	£4
.....	
<b>TOTAL</b>	<b>£22</b>

You'll also need a lint-free cloth, available in a five-pack from [www.amazon.co.uk](http://www.amazon.co.uk) for £3.77

To do this, first remove the heatsink from the processor as per the manufacturer's instructions. Remove the existing thermal compound using a lint-free cloth dabbed with isopropyl alcohol.

Apply a small blob of thermal compound to the top of the processor. Once the processor is operating, the heat will spread the paste. Re-attach the heatsink, making sure it fits tightly. If it isn't fitted properly, you run the severe risk of overheating, which can be fatal for your PC.

## Invisible wire

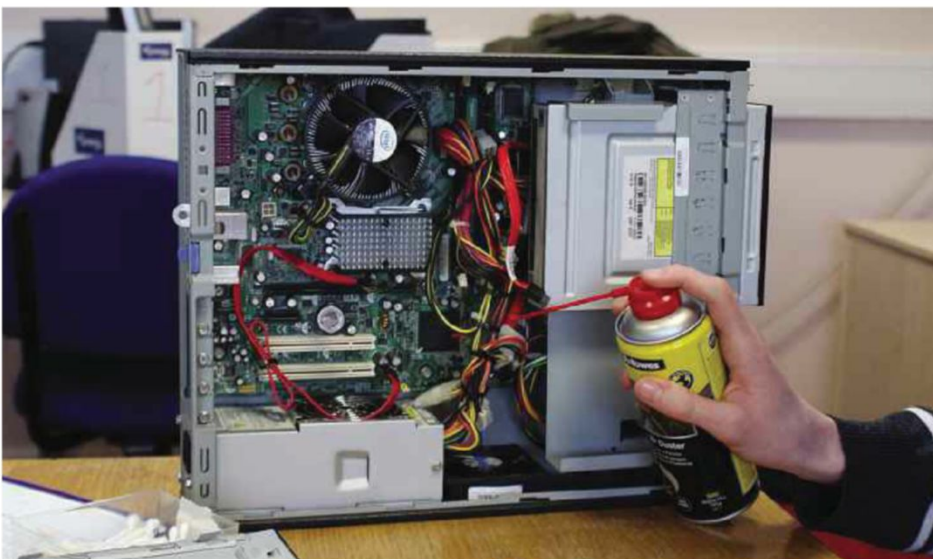
There are lots of power and data cables inside your PC, which can be messy. They can also impede airflow through your case. Fortunately, you can solve this problem using cable ties.

First, find any cables that aren't in use; there are normally a few unused power cables in a PC. Fold them up and secure them with a cable tie attached to the chassis to keep them out of the way. Now find any cables that run between roughly the same points and bunch them together before tying them up and to the chassis. Finally, find any cables that have excess amounts of slack; you may find your flat IDE ribbon cables are too long, for example. Put a kink in the cable and tie it up.

## Ventilate than never

Case fans should draw air over your PC's components and out of the case. As the power supply already blows air out of the back of the case, your rear case fan should be oriented so it blows air in the same direction.

Make sure any front-mounted fans are pulling cool air in and blowing it over your motherboard. Fans have an arrow on them that shows the direction of airflow. If any fans are mounted incorrectly, undo the screws and turn the fan around before reattaching it. **mm**



▲ You should clean your motherboard carefully with an air duster

# Retro Gaming News

**Einar Saukas, whose game Pixel Quest was our favourite retro game of 2015, is back with another puzzler on the Spectrum. Dave Edwards takes a look...**

**A** brand new game for 48K+ Spectrums, and the more recent ZX Vega, *Snake Escape* ([tinyurl.com/hpjb9f7](http://tinyurl.com/hpjb9f7)) is the work of Einar Saukas (He of *Pixel Quest* and *Alter Ego* fame). That means you can expect quality from the word go, and *Snake Escape* certainly doesn't disappoint. Like the versions of Snake you know, it involves a slithering reptile eating big, juicy apples, but everything else about it is very far removed from that concept.

In *Snake Escape*, each level is viewed from the side – something that takes a bit of getting used to. Snakeface grows each time you make a single move in any direction. And getting to the single apple per level isn't as easy as the usual angling your snaky head in its direction. No, Snakeface must, in *Snake Escape*, contend with gravity, and gravity sends his head plummeting to the lowest empty position on screen whenever it is not supported by anything.

The first thing you notice as you control Snakeface is that he can't stretch upwards more than three squares. Indeed, if you try he gets rather red in the face and stubbornly refuses to go any further. The second is that you can predict what will happen to him at least two or three moves ahead – for example, if you're about to move his head left or right and there's nothing to support it, then it will quickly fall to the nearest surface. The third is that, because if he can't move it is game over, innocent-looking gaps in the ground are actually fatal; if you fall into them then there's no escape! All three elements combine to teach you exactly how Snakeface must be controlled in order to reach the elusive apple. The screenshots illustrate how you essentially need to put on your thinking cap and make use of your tail to support you on your crawl to victory.

This is a remarkably addictive little game – it's one where each screen generally only has a single solution, but only a lot of brain-strain (or trial and error) will allow you to work it out. If (or should that be when) you get stuck, a simple tap on the space bar will allow you to give up and restart on the same level. There's no lives system, so you can play until you beat the screen or give up in frustration.

The only proviso to be aware of is that the game features some great pieces of music – four individual tunes in fact! – but you only get them on the 128K Speccy models. If you load it on a 48K model, it will run in complete silence. Needless to say, the game is much improved with the music. The music does, however, change each level. The first few levels are relatively easy so when you first play *Snake Escape*, you may hear only about ten seconds of each tune before it switches to a different one!

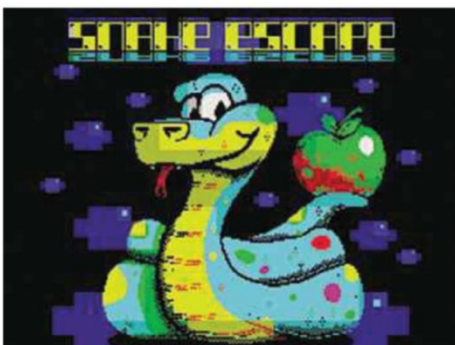
As with many of Einar's other games, *Snake Escape* is written using the Nirvana+ engine, which means that, even though the game uses all the Spectrum's colour palette, there's no attribute clash whatsoever. Apparently, the concept of a gravity-encumbered snake has been done before in a little-known game called *Lime Rick*. However, I suspect most people will have neither heard of nor seen this concept before... which is great, because it means *Snake Escape* will be, for many, a brand new type of puzzle game.

It's available completely free of charge and contains 42 levels in total. So far I've reached level ten, which has introduced a box Snakeface can push around... and which obviously needs to be pushed into that gap which otherwise will trap Snakeface when he tries to pass over it. My head-scratching continues...

## CPCRetroDev2016: The Verdict

Last issue, you'll recall our coverage of the top ten entrants for Amstrad competition CPCRetroDev2016. That article was just a quarter of the whole story, though, and you can now, if you wish, watch my controversial reviews of every one of the 34 entries on YouTube at [tinyurl.com/hd79zfo](http://tinyurl.com/hd79zfo). See you next week! **mm**

**Scores**  
**Graphics: 72%**  
**Sound: 85%**  
**Playability: 89%**  
**Lastability: 56%**  
**Overall: 76%**



▲ Loading. Please wait



▲ Well, that didn't work. One move left and it's all over



▲ Ah, now I see it. Easy when you know how!

# Remembering...

## HP-9800 Series Calculators

### We look at the grandfather of the modern desktop computer

**M**ention a HP product today and most users will likely point out one of the company's range of printers. However, if you were to travel back to the early 70s, that response would have been radically different.

Founded in 1935, Hewlett-Packard already had a rich history with electronics enthusiasts and businesses long before it ever took to making desktop computers, printers or servers. Back in its youth, the company manufactured electronic test equipment and signal generators. But 1968 saw it launch one of the most important advances in consumer technology: the HP-9100A, a desktop calculator that was/wasn't a desktop computer.

Despite being able to be programmed and work as a computer, the HP-9100A wasn't labelled as a computer. As Bill Hewlett once said, "If we had called it a computer, it would have been rejected by our customers' computer gurus because it didn't look like an IBM. We therefore decided to call it a calculator and all such nonsense disappeared."

The HP-9100A was hugely successful, so in 1971 the company launched a new model: the HP-9810A. This new generation, the HP-9800 Series, was a quantum leap ahead of anything else of

the time. Incorporating such technology as magnetic cards, an LED display, BASIC interpreter, a built-in cassette drive and a huge 4KB of memory – upgradeable to 8KB – the HP-9800 Series was the obvious choice for both professionals and home users.

Indeed, the modern desktop computer owes a lot to the HP-9800 Series. In fact, many pundits state that the HP-9800 Series is the ancestor of the modern personal computer.

#### Its History

The HP-9100A lasted a surprisingly long time, in terms of emerging technology. The excellent engineering process and reasonably low price of \$5,000 meant that this, being the world's first scientific calculator, was the go-to product for businesses across America.

Toward the end of its life, though, HP was ordered to pay Olivetti the substantial sum of \$900,000 after the company copied much of the technology from Olivetti's Programma 101. The fine hit HP hard, and work was accelerated to get the next generation of 'calculators' into the hands of the users.

The HP-9810A was launched in 1971 and was an instant success. A year later, the HP-9820A appeared, offering more

#### Did You Know?

- Early desktop computers thereafter were still marketed as 'calculators' to help make business purchasing easier.
- The cassette tapes used could hold 64KB of data, loading at a read speed of 3KB per second.
- The HP-9830A had four I/O ports at the rear for printers, plotters and scientific and engineering peripherals.
- Originally priced at around \$6,000, a few years ago a fully working HP9830A sold for just over \$25,000.

memory and HPL (High Performance Language). Within a few months, the modified HP-9821A was released, which was identical to the previous model, but instead of magnetic cards, HP opted for cassettes as the storage medium.

Finally, early in 1973, HP launched the last model of the 9800 Series. The HP-9830A was an impressive machine, boasting up to 8KB of memory, four CPU boards that totalled 8MHz, a 32-character LED, built-in cassette drive (with a five-cassette storage panel to one side) and an optional thermal printer.

The HP-9830A was a breakthrough machine. With 16 circuit boards within its 20kg chassis, this monstrous 'calculator' was the poster child of the scientific and business communities. Later re-released models could even be upgraded to a huge 32KB.

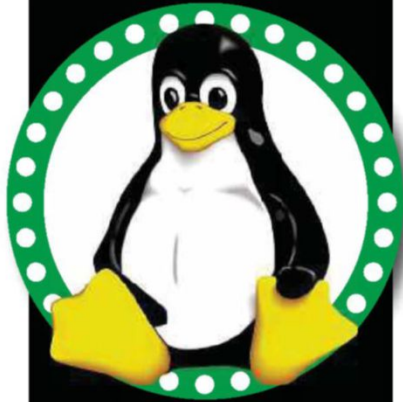
Despite being described by the community and HP as calculators, the HP-9800 Series eventually evolved into the HP Series 80 computers, which were then used as the benchmark for IBM and Apple-based personal computers. [mm](#)



▲ The 1971 HP-9810A, looking more calculator than desktop computer



▲ By 1973, the HP-9830A became the ancestor of the modern PC



# Linux supercomputing

## Linux still the superpower behind supercomputers

Supercomputing has always been an interest of mine, ever since learning about the Cray-2 from 1985 with its four liquid-cooled processors and 256 MWord memory. It was like something from science fiction, and I dreamed of one day being able to be in command of such an impressive machine.

and engineers find solutions to everything from global warming to the best method for building earthquake proof building.

The AI portion is said to be the most advanced ever developed, and has the ability to self-learn and design deep learning networks for itself, which isn't scary in the slightest.

10,649,600 processing cores and runs the Linux-based Sunway RaiseOS 2.0.5.

However, despite China's lead, Japan is stepping up to the plate by announcing that it will soon be revealing a new \$173 million supercomputer that will be twice as powerful and fast as the current leader. At present, Japan sits sixth and seventh in the charts but, according to Satoshi Sekiguchi, the director-general at Japan's National Institute of Advanced Industrial Science and Technology, this new system will incorporate some new technologies that will give it the much needed boost to lead the charts for some time to come.

It is assumed that Fujitsu will be helping to build the system, along with software engineers who will be developing a new Linux system to interpret the 130-petaflops the supercomputer will generate when it eventually goes live.

The big question of course is, will it run *Crysis*?

▼ *Nvidia's new supercomputer, so much power...*

“ Despite China's lead, Japan is stepping up to the plate ”

Although I never got to play around with a Cray Supercomputer my job as a tech journalist affords me some compensation by being one of the first to learn of new supercomputing technologies. So I'm half-way there.

Recent news is that the custom Linux-driven NVidia DGX SaturnV has been ranked as the world's most efficient supercomputer – as well as being the 28th fastest supercomputer on the planet. The SaturnV is powered by the firm's own Tesla P100 GPUs, of which it has 125, alongside 63,488GB of memory and 60,512 Intel Xeon E5-2698v4 processors. Impressively, this little lot is 2.3 times more energy efficient than the previous record holder, the Camphore 2.

The SaturnV is an accelerated AI supercomputer, which is capable of perceiving the world as we do; helping scientists

### Japan's New Supercomputer

China has historically led the supercomputer charts for quite a few years now. As of November the country holds both the first and second place fastest supercomputer positions with the Tianhe-2 supercluster, and the current leader, the Sunway TaihuLight – a system that boasts 1,310,720GB of memory,

DGX SATURNV



David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

# Linux

# Links Galore

## Sven Harvey isn't ruining a good walk, either

There are a lot of Amiga related web sites out there, and the internet is generally a very noisy place. It can be difficult to cut through the static and overwhelming array of content to find that which is of real use. Amiga Mart to the rescue – here are some of my favourite sites, that you really should check out.

### AmigaRemix

A daughter of the C64 Remix site, Amiga Remix hosts MP3s of user-created remixes of classic Amiga game and demo tunes. I say 'user-created,' but there are often remixes of work done by musicians from the period, such as Tim 'CoLD SToRAGE' Wright and Allister Brimble remixing the work of Ben Daglish and Romeo Knight. The site is set up with the latest remixes that were uploaded being listed first, and a smiley face rating system with public voting that, though not infallible, seems accurate 99% of the time.

You can play the remixes from a browser or right click and save

to pop it onto your hard disk for playlist duties later. They're just the thing to throw into WinAmp.

Expect a lot of *Turrican*, *Shadow Of The Beast* and other famous track remixes. Check the tunes at [www.amigaremix.com](http://www.amigaremix.com).

### Gaming Information

There are a couple of great databases of Amiga games to help you work out quite what it is you are remembering. Lemon Amiga is more than just a database, though. It allows interaction via a forum, as well as encouraging reviews, comments and ratings on the games. Screenshots, and other images are available in a very clean front end. Find the site at [www.lemonamiga.com](http://www.lemonamiga.com).

*Hall Of Light* is more database like, but holds more information, and more examples of things like pack shots, manual scans, review links, and even images of adverts for the games. Conversion screenshots are also shown allowing you to compare versions (*R-Type* being a good example

f this at [hol.abime.net/1288/conversionshot](http://hol.abime.net/1288/conversionshot)). You can find Hall Of Light at [hol.abime.net](http://hol.abime.net).

Another part of [abime.net](http://abime.net) is the Amiga Magazine Rack, which offers an archive of the Amiga magazines released during the Commodore Amiga platform's heyday, which can be found at [amr.abime.net](http://amr.abime.net), or you can access everything at the set of sites via the Amiga Lore front-end at [www.abime.net](http://www.abime.net) including Amiga Games That Weren't and others.

If you are after actual games to play you can do far worse than pop to Dream 17 ([www.dream17.info](http://www.dream17.info)), and Factor 5's site ([www.factor5.de](http://www.factor5.de)) and check out the legal downloads. Of course you should always check out [aminet.net](http://aminet.net)!



Sven Harvey has been our Amiga specialist for over 17 years drawing on his 25 years retailing computer and videogames and nearly 30 years writing about them!

### Community Spirit

Commodore may have collapsed in 1994, but it's users and their community spirit has kept the Amiga alive – or at least, as undead as a frankensteined A1200 – since then. Community sites such AmigaWorld ([www.amigaworld.net](http://www.amigaworld.net)), Amigans ([www.amigans.net](http://www.amigans.net)) and, of course, Amiga.org (err... at [www.amiga.org](http://www.amiga.org)) a community of Amiga users has kept things alive, even with a fair amount of trolling, and more let downs from companies than most computing platforms could survive (and far more law suits than anyone thought viable). There are also active user groups that you may want to contact:

#### South West Amiga Group

Stretches from Reading to Cardiff and down to Exeter – so far.

[www.southwestamiga.co.uk](http://www.southwestamiga.co.uk)

#### Lincs Amiga Group

Lincolnshire and surrounding area (meets/events based in Welton-by-Lincoln)  
[lincsamiga.org.uk](http://lincsamiga.org.uk)

#### Amiga North Thames

North East Greater London and surrounding area (meets/events based in Enfield, Middlesex)  
[www.amiganorththames.co.uk](http://www.amiganorththames.co.uk)

#### North West Amiga Group

North West England (Meets/events based around Runcorn)  
[www.bambi-amiga.co.uk/spudmiga/nwag](http://www.bambi-amiga.co.uk/spudmiga/nwag)

#### Amiga Users Ireland

Eire (Meets/events based in Galway)  
[www.meetup.com/Amiga-Users-Ireland](http://www.meetup.com/Amiga-Users-Ireland)

# Amiga



Ian McGurren is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

# Mobile

# So Here It Is

Ian McGurren looks at some of the best gifts for Christmas 2016-11-29

**W**hile 2016 has been quite possibly the year where someone has put the difficulty of human existence up to 'Legendary', as of writing this, Christmas is still happening (of course if it's been cancelled by the time you read this, buying tech tat for your loved ones will be the least of your worries). So, in the true spirit of the season, crack open your festive-themed cola drink and feast your eyes on a list of the best gifts for the mobile lover in your life.

## Phones

2016 hasn't been the most exciting year for mobile released, but we've seen a fair few good examples (and one dangerous one). The Galaxy S7/S7 Edge were quite similar to the previous S6, but still comfortably the best Android handsets of the year. As Christmas approaches, they're now benefitting from pretty heavy discounts of at least 30% (with the S6 and S6 Edge discounted even further).

Google's Pixel and Pixel XL, now the main rival to the Galaxy S, is ideal for the Android purist. As it's still new, so won't see you much change from £600, though. Likewise, the iPhone 7 is the pinnacle of iOS hardware, but is so expensive right now – and not without its issues. However, the now reduced 6S is still every bit as good and is well worth a look.

In real budget terms, the Motorola Moto G4 Plus offers excellent value for money, with a spec that would have been flagship 18 months ago, as well as a fingerprint reader for Android Pay. Cheaper still is the Moto G Play, a Moto E for 2016

with a similar spec to its forebears for much less – and it has Android 7 coming too.

There are also value handsets from Wileyfox – the older Storm and new Swift 2 Plus, Huawei's Honor 5C and Vodafone's own follow-up to last year's excellent Smart Ultra 6, the Smart Ultra 7

## Tablets

This year we did have to say goodbye to the gold standard of budget tablets, Google's excellent Nexus line. This left something of a gap in quality flashable hardware at the bottom of the Android market, though there are still good tablets at around £100 – with Amazon's Fire and Samsung's Galaxy Tabs still offering a perfectly serviceable experience. Admittedly, in the Fire's case that is restricted somewhat by the OS, while the Galaxy might leave you waiting for OS updates.

For the perfectionists, there are some attractive options, though. Android is served by the excellent Google Pixel C, now the only Google tablet with the Nexus 9 being phased out. There's also the Samsung Galaxy Tab S2; yes, it was released in 2015, but there's not been an update to an S3 yet, and it still features that staggeringly

gorgeous Super AMOLED screen in 9.7" or 8" 4:3 sizes.

Talking of Galaxy Tab, 2016 is the year of the Galaxy Tab Pro S, a 'two-in-one' Windows 10 tablet with keyboard. Apart from the pretty decent spec (Core M3, a middling 4GB RAM), it wouldn't be a Galaxy Tab S without a Super AMOLED screen, and as expected a 12" 2160 x 1440 one delivers in spades and can be picked up for around £500.

If you're gonna really go Windows, though, you might as well go all in. That means it's still the Microsoft Surface Pro 4 that's the top device. It offers the best of both worlds: a not-unreasonable tablet-cum-hobbled-laptop. It's also, arguably, becoming the best option for Apple-centric designers on the move, as it comes with the power of a fully functioning Adobe suite and a touch interface (ably demonstrated in the Surface TV spots) outgunning the underwhelming 2016 Macbook Pro.

While it's business as usual on the tablet and phone front this year – no great shakes at either end of the price spectrum, and few surprises. There's still a chance you can grab something that will suit your pocket and light up the face of the recipient, though.



# Crucial Executive Perks

Andrew Unsworth checks out Storage Executive, Crucial's SSD admin utility.

Last week I mentioned that I'd finally put my hand in my pocket and bought a 750GB SSD to replace the existing 240GB SSD in my setup, as the 240GB SSD was 'needed' in a new build for someone. The model I chose was the Crucial MX300, as I'd been a fan of the M500, had a soft spot for some other Crucial SSDs, and the MX300 range is well priced. Last week, we looked at the bundled Acronis True Image HD disk cloning and backup tool, and how easy it is to clone an existing drive to the new SSD. This week, I'm turning to the admin utility.

Many manufacturers provide SSD monitoring, configuration and maintenance tools, and Crucial is no exception, as it provides its Storage Executive utility as a free download from its website ([www.crucial.com](http://www.crucial.com)). Other SSD tools that I've used are regular Windows applications, but Crucial's Storage Executive runs as a web service and is accessed as a web page. This is no impediment to its use, but I'd prefer it to be a native application as it can be a bit slow when

changing pages. Hopefully the next version will be a native app.

Storage Executive provides information on all the installed drives, not just Crucial SSDs. That information includes the capacity and temperature of a drive, both of which are shown graphically as well as textually. Other data includes the driver version, firmware version, connection interface, speed, and the driver's serial number. Storage Executive can also give optimisation tips.

Other data it provides includes a table of S.M.A.R.T. attributes and the number of times an event represented by an attribute, such as an unexpected loss of power, has occurred. Storage Executive will also install the latest firmware to the drive within Windows and without the need to reboot, if possible. It also provides users with the option of 'sanitizing' their drive, which means permanently deleting all of their data so that it can't be recovered, and allows users to specify over-provisioning options to improve performance.

What will interest most users, however, is the Momentum

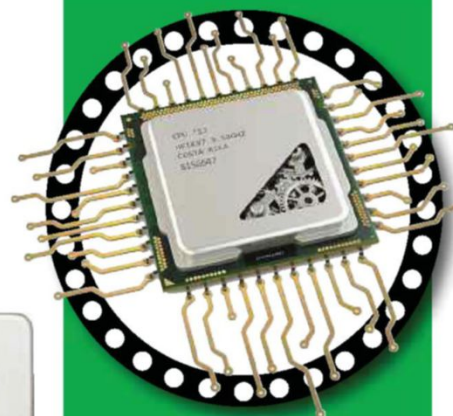


Cache feature, which may improve the performance of the drive. To enable it, users just have to click a button and reboot.

I found that Samsung Magician, which is Samsung's SSD management utility, was faster at switching screens because of its nature as a native application, and I also find Magician a more engaging app all-round. Magician will also optimise the operating system, it has a neat benchmarking feature with the ability to compare historic results, and it has a better designed dashboard. However, there's nothing wrong with Storage Executive and if you buy a Crucial SSD MX300 then Storage Executive will provide all the features you need and more, and the bundled Acronis True Image HD adds even more value.

As for data transfer speeds, The AS SSD benchmark tool reports that my 750GB MX300 has a maximum sequential data transfer speed of 480MB/s and a maximum write speed of 459MB/s. Random read and write speeds were 440MB/s and 315MB/s respectively.

It'd be good to test an m.2 NVMe SSD, just to experience the day-to-day speed of it, but until I can justify building a decent Skylake or Broadwell-E setup to my beloved wife, that won't be happening. However, you should always make the most of what you do have, and a high-quality, large capacity SATA SSD is certainly good enough for me.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner and his handshaking skills are second to none

# Hardware





Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

## Watch This Space

Will the ability to construct bases bring players back to the space sim *No Man's Sky*? Hello Games thinks so, as it releases its *Foundation* update

This week, Ryan takes a look at the new update for *No Man's Sky* and ponders the slow sales of this autumn's biggest releases...

### Plug & Play

In some respects, we can hardly blame Hello Games for going a bit quiet for the past three months or so. Before its release in the summer, the indie team's space sim *No Man's Sky* was easily among the most anticipated titles of 2016: a game that purported to offer an entire open-ended galaxy of planets teeming with life. The trailers hinted at extraordinary vistas and weird, procedurally generated systems where no two worlds were quite alike. Mysteries abounded: what did you do? Was there a specific objective? Even these questions only added to the game's allure.

After the release came the backlash; you only have to type 'No Man's Sky' into YouTube's search box to see just how angrily some gamers have responded. Common criticisms include the lack of variety in the planets, the speed at which repetition sets into the survival gameplay, and the surprising lack of a multiplayer mode and other features discussed by designer Sean Murray before *No Man's Sky* came out. Indeed, complaints about alleged false advertising became so vociferous that the

Advertising Standards Agency got involved in September.

In the wake of that response, Hello Games appeared to go into lockdown, with the last proper update appearing on the developer's social channels in August. In late November, however, Hello Games finally broke its silence, and revealed what it's been up to for the past 100 days or so: a "major update" entitled *Foundation*, adds a base building mechanic to its exploration game. At the same time, the studio's update also addressed its three months of unnerving silence.

"The discussion around *No Man's Sky* since release has been intense and dramatic," the team's post read. "We have been quiet, but we are listening and focusing on improving the game that our team loves and feels so passionately about."

*Foundation* not only allows players to commandeer existing bases, add to them or build new ones from scratch, but also adds a *Minecraft*-like creative mode – for those who want to skip the grinding – and a survival mode, for players who enjoy the resource-gathering elements of the game. Judging by the sheer

size of the *Foundation* update, it's clear that Hello Games realises that it's having to work hard in order to win back the trust of its players. *No Man's Sky* was a huge success, but so too was its backlash. With the *Foundation* update, maybe – just maybe – Hello Games can start bringing its space adventure closer to the grand vision that captured its audience's imagination in the first place.

### Online

What do *Watch Dogs 2*, *Dishonored 2* and *Titanfall 2* have in common? A fair bit, now we think about it, but as of late November 2016, one regrettable detail in particular: they're all sequels whose sales have fallen significantly below their predecessors. We heard last week that *Titanfall 2* had underperformed – perhaps in no small part because it came out so close to EA's other big autumn shooter, *Battlefield 1* – but it's now clear that those slow sales were far from an isolated blip.

Ubisoft was hoping for big things from *Watch Dogs 2*, its open-world hacking sequel, given that the first game was so hugely successful. Reports





▲ Despite established names and good reviews in some instances, this autumn's big games - *Watch Dogs 2*, *Dishonored 2* among them - have sold less than expected...

suggested that it sold around 380,000 physical copies at launch, which is good going for a brand new property. Its sequel, by contrast, is reckoned to have sold a fraction of that during its first week on sale; leaked data reported by Eurogamer puts the figure at as little as 80,000 copies.

Ditto *Dishonored 2*, Bethesda's sequel to its 2012 steam punk murder sim. Launched on 11th November, its sales were reportedly down 38% on the original. That's another significant drop, particularly given that, like

*Watch Dogs* and *Titanfall*, we're talking about games with an established name behind them. So what's going on? Well, having all these big-budget titles appear within a matter of days of each other isn't going to help, particularly so close to *Call Of Duty: Infinite Warfare* – though even that shooter sequel's sales were lower than expected. As ever, the sales figures mentioned here don't cover digital copies purchased on Steam and other online services, but this can't entirely explain why the numbers are down so drastically.

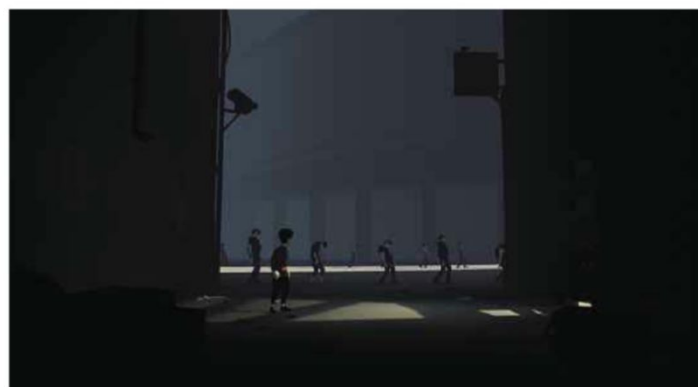
The slowdown is likely due to a number of factors: an increased caution among gamers, who after the likes of *No Man's Sky* have hesitated to place pre-orders on titles they haven't played. Another is the increasing prominence of November's Black Friday sales: with so many outlets offering huge discounts on new-ish games (there's about 40% off *Titanfall 2* at Amazon as we type this), why rush to buy them at launch? Then there's the increasing staying power of rival games. *Overwatch* may have been released months ago, but it's surely significant that even this far out from its launch, the online shooter still has a spot in the UK's top 10 best-seller list.

For we gamers, there's a silver lining in the short-term: with so many decent games to choose from this autumn, we can enjoy hours of entertainment at bargain prices. But games like *Dishonored 2* and *Watch Dogs 2* cost many millions to make, and November's sales reports will surely provoke a bit of soul searching among

the firms that published them. If nothing else, the modern tradition of releasing the biggest titles in October, and November is fast becoming a dangerously expensive gamble.

## Incoming

If you're anything like us, the summer release of *Inside* may have completely passed you by. This is the sequel to Playdead's macabre platform-puzzler *Limbo*, a game rich in atmosphere and studded with imaginative and gory deaths. We're still shuddering at the giant spider. *Inside* is evidently in the same vein, with its 2.5D monochrome graphics implying a nightmarish yet fascinating world. There are also lots of environmental puzzles and plenty of opportunities to die a horrible, horrible death. The good news is that Playdead has put a playable demo on Steam, so if you've yet to take the plunge, we'd urge you to at least give it a try. Getting attacked by guard dogs has never been so much fun. **mm**



▲ We're ashamed to say we missed the launch of *Limbo* sequel *Inside*, but with a newly released demo on Steam, it's a great time to catch up with the indie platformer

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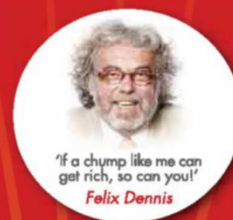
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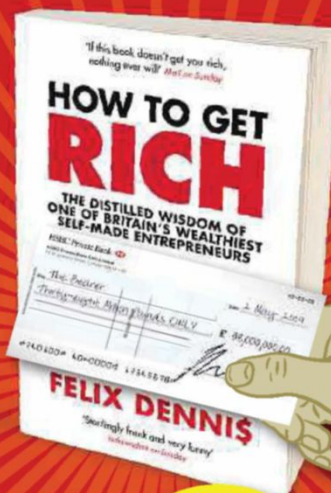
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Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

*Aaron*

## Unwanted guest

I used to use Avast antivirus free, which a friend installed on my laptop for me, and it worked very well. It was certainly better than the expensive Trend option that came with my computer with a so-called 'free' subscription that lasted 30 days.

I had Avast installed on my friend's recommendation, and all has gone well for a while. Now, though, I've noticed that Avast has disappeared from my system, and I can no longer find it anywhere. In its place, it looks like I have a copy of McAfee instead, a program that I certainly never installed myself, so I'm not sure where it came from.

This copy of McAfee seems to have removed Avast from my system, and I'd like to get it back. I don't know where the new program came from, so I'd appreciate any suggestions you may have.

**Leslie**

*I'm not sure what help you asking for here, Leslie, but I'm assuming you'd like to know where the McAfee app came from and how to get rid of it.*

*I've not had the issue myself, but I have heard that a few people have downloaded software that's offered to install a copy of McAfee on their system at the same time. A common one a while back was Adobe's Acrobat Reader. This would install a version of the antivirus software on your system unless you opted out during installation. I suspect this is the source of your trouble, and you may have inadvertently installed it as you simply missed the option or notification.*

*All you need to do to remedy the situation is uninstall the McAfee software via Control Panel as you would any other program and then restart your system. Once you're done, download and reinstall Avast from its website (that's [www.avast.com](http://www.avast.com)).*

*This should put things back as they were before McAfee interfered with your system as you knew it. However, in order to avoid any further problems in future, we'd suggest that you keep a close eye on any software installers you come in contact with, and always opt out*

**“ All you need to do is uninstall the McAfee software ”**

*of any special offers and additional software they may offer as additional extras. There are a lot out there that can easily fool you if you're not careful.*

*If you have any further issues removing the McAfee software, you can use McAfee's Consumer Products Removal tool (MCPR), a tip I've provided a few times. It's a very good solution to any possible issues caused by leftover files, and it's quick and easy to do. You can find the removal tool at [intel.ly/2gycmNP](http://intel.ly/2gycmNP). It's free, and easy to use.*

**▼ Sometimes software installers, even for big companies, can try to install extra, unwanted software**

The screenshot shows the Adobe Reader download page. At the top, there are navigation links: Products, Solutions, Learning, Help, Downloads, Company, Buy, and a search bar. The main heading is 'Adobe Reader'. Below this, there's a section for 'Adobe Reader X (10.1.4) (48.49 MB)'. It indicates the system is 'Windows 7, English' and asks if the user has a different language or operating system. A prominent McAfee Security Scan Plus pop-up is overlaid on the page, offering a 'Free! McAfee Security Scan Plus' to check the status of the PC security. There is a checkbox for 'Yes, install McAfee Security Scan Plus - optional (0.98 MB)'. Below the pop-up, there's a 'Download now' button and a note: 'Please note, depending on your settings, you may have to temporarily disable your antivirus software.'

## Recycle

I have an old laptop, which was given to me by a cousin who no longer needs it. It's not a bad system, only a couple of years old, and it should be good enough for what I need it for. There's one problem, though. It has Windows 8.1 installed on it, and it's locked with an administrator password. My cousin hasn't used the laptop for some time, and can't remember the password at all. To make matters worse, he also hasn't got an install disk, so I can't just reinstall Windows and start again, which is what I really want to do.

I'd really like to be able to use the laptop, but at the moment I can't do anything as I don't have a copy of Windows, and I can't afford to get another one. It's such a shame, as it already has Windows on it, and it's legitimate, I just can't use it. Can you help?

Ian

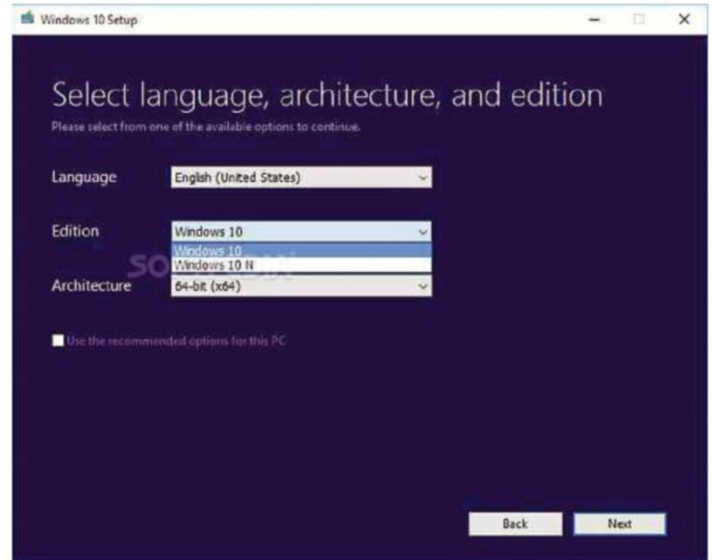
Depending on the make and model of the laptop in question, you may be able to reinstall Windows using the recovery partition. This can often be accessed from the BIOS/UEFI, although sometimes the required software needs to be accessed in Windows itself. Check the BIOS for any reference to this and give it a go if possible.

Failing this, you'll need to reinstall Windows the old way, but you should be able to do this using Microsoft's Media Creation Tool, which you can download from [www.microsoft.com](http://www.microsoft.com), or any number of download sites, such as Softpedia ([bit.ly/2fDUxy4](http://bit.ly/2fDUxy4)). Once you have this, you can use the tool to create install media, and once this is done, you can reinstall Windows on the laptop. As the laptop presumably has an OEM copy of Windows installed,

there's a very good chance it'll also have the product key integrated into the BIOS, so you won't need to manually enter it.

This should get you back up and running on the laptop quickly. It may also be worth visiting the manufacturer's website for any possible rescue disc images and/or OEM software.

▼ Microsoft's Media Creation Tool can help if you've lost your Windows install media



## XP Gaming Shutdown

I still have an older computer running Windows XP that I use for some gaming, mainly older titles that no longer work on newer machines. The system is around five years old, and the specification is perfect for what I use it for, except for my issue.

When I'm playing some games I often get a blue screen followed by the system shutting down. This can happen randomly, but only seems to happen when I'm playing games, not when I'm doing anything else. I mainly play older FPS games, as well as some RPGs, but I've not been able to use it lately.

I don't know why it's started to malfunction all of a sudden. It's sat underneath my main PC for some time and has worked fine, and I've not updated anything, so I'm at a loss. I'd be very grateful for some help.

Sam

Based on the symptoms you've described, and the manifestation of the problem only when you're gaming on the PC, I'm fairly certain your issue here is down to overheating. Although the system is older, and therefore has older, low power hardware, it can still overheat. You also say the system is sat below your main system, which could compound the issue.

I'd first pull out the PC and check the rear vents and other openings are free of dust. Open up the system and do the same for the fans and heat sinks. If it's very dusty, give it a good clean. Once you do this, try to place the system in a more open, and ventilated location. If it's on carpet at the moment, this can promote increased build up of dust and heat. Also, being sat underneath another system means it could be having more problems with ventilation.

As long as there's plenty of room for good airflow and no dust and dirt clogging up the innards, you should be okay and can test the system. I'd wager it'll run properly. For an even better test, try running the system with the side(s) off.

▼ Cleaning and cooling is important, even if you're running an older system



# ASK JASON



**Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs**

Send your questions to:  
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Contact Jason by email at:  
[jason@micromart.co.uk](mailto:jason@micromart.co.uk)

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

# Jason

## Story Of The Blues

I've just purchased a Roberts Eco4 Bt radio. This supports Bluetooth, and I've now tried to pair three sets of headphones to it, without success. Have you any idea what I'm doing wrong (assuming the radio isn't faulty)?

**Will, Outlook.com**

*As far as I can tell, Will, the Eco4 Bt can receive Bluetooth audio but not transmit it. It'll allow the user to stream music from another device, such as a phone, tablet, or MP3 player, but I don't think the reverse is true. It looks as though it's not possible to stream music \*to\* another device.*

*Bluetooth audio streaming uses A2DP (Advanced Audio Distribution Profile). This supports both receiving and transmitting, but most devices are designed for only one or the other. I'm not sure, but it could be that headphone pairing also requires HSP (Headset Profile), and your Roberts definitely doesn't feature that (view the manual at <https://goo.gl/L87JBa>). A profile, by the way, is a sort of driver that determines what behaviour a Bluetooth device supports.*

*One solution is to buy a Bluetooth transmitter. This would plug into the radio's 3.5mm headphone socket, convert the analogue signal to digital, and pump it out via Bluetooth. Your*

*headphones would have no trouble pairing with something like that. Have a browse in the usual online shops – prices start from around a tenner.*

*You may want to consider a Bluetooth transceiver – a 3.5mm unit that'll work both ways. They're barely any more expensive. Such a device is a great way to breathe new life into an old hi-fi. Some old hi-fis are just too good to throw away, but they can be limited in today's world by having no wireless connectivity. Shove a Bluetooth receiver into the mic or aux socket and you're straight back in 2016, able to stream to the hi-fi from phones and tabs and so on, effectively creating a giant sound dock.*

▼ **A 3.5mm Bluetooth receiver is a great way to make a non-wireless audio device useful again**



## Toy Story

Some while back – a couple of years, at least, I should think – you mentioned a Windows game that was like a cartoon version of Doom or Wolfenstein 3D. I downloaded it and enjoyed it immensely. I'd like to play it again, maybe with my young nephew, but for the life of me I can't remember what it's called. Does it ring any bells?

**S. James, Herefordshire**

*I can only think you're referring to Bad Toys 3D. I'm not surprised you enjoyed it immensely. It's awesome. I've not played it within the last twelve months, so thank you for reminding me.*

*Of course, it's as old as the hills, released in 1998, back when Windows 95 was still a novelty. I suppose today the game might qualify as being so bad it's good. And, my word, it \*is\* good. What a terrific retro blast. The Czech developer still has it up for sale, still priced at \$9.95 (nearly £8, gawd help us) – the cheek of the man! Point your browser at <https://goo.gl/zRhLML>. There's a free trial, featuring three of the twenty-five levels, and quite frankly I think it should be a criminal offence not to give it a spin.*

*One fly in the soup is that it doesn't work on 64-bit versions of Windows (I suspect it's 16-bit, though that isn't always a deal-breaker). Even with 32-bit, the limit is Windows 7. If you're on Windows 8.x or 10, you'll probably have to set up a virtual machine running XP or earlier, as if I recall, even compatibility mode won't help. Visit <https://goo.gl/gHQmXc> to grab VirtualBox, and for free and official trial editions of pre-made Windows virtual machines, visit <https://goo.gl/aXiFDu>.*

▼ **Need I say more?**



## Board To Death

I have a very old PC that's used for a small industrial project. The motherboard has failed. The PC is an HP job, and from what I can tell the motherboard is a P4SD – if that means anything. The CPU is a 2.66GHz Pentium 4. What are my options? Ideally, I'd like to buy a new replacement motherboard – is that a likely prospect? The PC runs Windows XP, but it's not online and I doubt my custom software will run on anything newer.

**Michael, Gmail**

*Hmm. I can see you're in a bit of a bind here. A new motherboard is a non-starter, really, and even if you could track one down, it would be old stock. I fancy that an unused board that's been sat on a shelf for a decade is just as likely to see imminent failure as a board that's had constant use and been recently removed from a working system.*

*As ever, eBay is your friend, Michael. As I write, several examples of the P4SD are on sale. None are in the UK, but a few are in Europe, with an all-in price of under £50. Steep, but not prohibitive in a critical situation like yours. There's no telling how long such a motherboard will last, but it'll get you out of trouble for the time being.*

*The P4SD is a standard microATX affair – made by Asus, I think – so you could widen your search and fit something different. Any Socket 478 motherboard should do. The P4SD uses Intel's 865G chipset, so if you want to avoid the likelihood of having to reinstall Windows, ensure the replacement has the same (or very similar). Your board is the straight P4SD, but there*

*are other variants – the P4SD-VX and P4SD-LA, for example. The 2.66GHz Pentium 4 is quite an early model and should be compatible with pretty much all Socket 478 boards.*

*Bear in mind, though, that some Pentium 4 motherboards don't have an AGP slot. You're forced to use the chipset's integrated graphics. This will apply to boards with the 865GV chipset, for instance – note the 'V' (for 'value', I guess). If your current system has a dedicated graphics card and you need to retain it, don't get caught out.*

▼ *There are still a few Pentium 4 systems in use, and getting replacement parts (never mind reliable ones) can be tricky*



## New Year's Resolution?

I'm an old codger of 72 years who doesn't play games but does have an interest in photography. I recently took delivery of a PC based on a Core i5-6600 (quad-core, 3.3GHz), and a recent article in Micro Mart persuaded me to upgrade from the integrated graphics to a GeForce GT 730. I'm glad I did. However, will this adequately support a 2560 × 1600 resolution (over HDMI)? I've got my eyes on a new monitor, you see. Nvidia's specs suggest it'll be fine, but will I be shortening its life or introducing other disadvantages?

**Leslie Lawrence, Gmail**

*No worries, Leslie. The GeForce GT 730 will operate at a full 60Hz at that resolution. It's actually capable of higher resolutions, but only at 30Hz or 24Hz (see <https://goo.gl/5Pzb19>). That would be painful even for non-gaming activities, a point many people have realised when upgrading to 4K monitors. The HDMI output on many graphics cards can't handle 4K at 60Hz (it requires HDMI 2.0). DisplayPort rather than HDMI has become the standard for 4K (and beyond).*

*Will you be shortening the card's life? No. The higher the resolution, the higher the load on the card, but the cooling mechanism will have been designed to cope with that scenario. You'll soon know if your GT 730 is overheating – the PC*

*will crash. No damage is likely to ensue unless this happens repeatedly and you don't take action. Keep your case well ventilated and you'll be right.*

▼ *Can running a graphics card at its maximum resolution, especially a budget card, shorten its life?*



# Crowdfunding Corner

If anything's big in tech-themed crowdfunding, it's mobile accessories. And why not? Who doesn't love their smartphone? While this pair of projects may not be especially original, they do both look like excellent ways to beef up your mobile hardware

## U-Ring Magnetic Flash Drive

Apple gives you two options with their iPhones: nowhere near enough storage, and so much you can't actually afford it. While iCloud is supposed to compensate, few would agree that it does. But what alternatives are there?

The U-Ring is certainly one. This Lightning-compatible USB drive has a magnetic base so it can snap onto the back of your iPhone, and a 'universal ring' connector so you can attach it to your keys, bag, wallet or anything else that makes sense. It has a metallic single body design to make it tough, and built-in USB 3.0 connector so you can transfer files to and from it using a PC or Mac.

The associated app gives you the ability to view photos and videos, back up your iPhone, and manage the file encryption on the device. You can also play music from, and save video and photos directly to the device in case your phone is full. There are several versions available, but the cheapest one is 64GB and costs just \$69 (£55), which is far less than you'd pay to get 64GB extra storage built into your phone. The hardware will ship in February 2017.

**URL:** [kck.st/2gm5Awn](http://kck.st/2gm5Awn)

**Funding Ends:** Monday, 16th December 2016

## CorsPower 7

If you're not using an iPhone – or you've got more functions that you want to combine into a single device – the CorsPower is a portable hard drive and power bank with built-in Qi compatibility.

The good news is that if you've got a non-Qi phone you can still plug in the adaptor for wireless charging compatibility or use the USB ports as normal, and the built-in 10,000mAh battery should be enough to charge any phone several times over, as well as tablets and other USB-compatible devices. Storage-wise it adds up to 256GB – considerably more than most phones and enough for several devices to be backed up onto.

These features might sound expensive, of course, but this project is based in China so it's operating at a severe advantage to most when it comes to being cost-effective. The most basic version of the device (if you discount early bird tiers, as we usually do) ships for HK\$ 380, which is just £40. For that you get the battery pack with wireless charging and 32GB of extra storage. There are other versions available, but if you want the 256GB version you'll have to shell out a much less cost-effective HK\$ 2,000 (£200) but again – that's still cheaper than adding the storage to your phone would be. Assuming this reaches its target, and we expect it to, devices will ship in February 2017.

**URL:** [kck.st/2gHa6q7](http://kck.st/2gHa6q7)

**Funding Ends:** Sunday, 8th January 2017



*Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!*

# App Of The Week

## TeamSpeak 3

### David Haywards checks out a superb VoIP solution

I've only recently bought myself a headset. Although I review plenty of them, I've never really committed to buying one for my own personal use.

For the last few weekends, my kids and I have been playing some online and LAN games, ranging from the ancient *Delta Force* – a game that I can actually win at – to the more modern *CS:GO*, *Rainbow Six Siege* and the *Borderlands* trio of games.

Both my kids have headsets, something we bought them a while ago to stop them from shouting requests at each other from their bedrooms when playing together on *Minecraft*. Admittedly, it just ends up with them shouting at each other while on their headsets. So I thought I'd join in, since I don't want to have to shout from my bedroom.

I didn't know what they used to communicate with each other while on their headsets, so when my son installed TeamSpeak 3, I was pleasantly surprised.

### More Than Just Gaming

I was expecting some minimalistic, pretty basic web-based chat app, but TeamSpeak 3 is quite the opposite.

This is a remarkable tool that allows you to join or create chat servers and channels, with varying permissions and privileges to any of the users who join in the conversation. You can easily, within a few clicks, set up a server channel that can accommodate a couple of users, through to something that can handle hundreds of participants from around the world.

There's AES encryption, public-private key authentication, Android and iOS versions and even file transfer options available. You can set up a company TeamSpeak server, for example, and allocate different conference rooms under the company name, granting access to the entire staff or just individuals to each separate room.

The audio is excellent, using the Opus audio codec, VoIP which also features Mono

### Features At A Glance

- Free for up to 32-users.
- AES encryption.
- Client and server model available, with permissions and privileges.
- Loads of audio options, along with connection settings.

Sound Expansion with mono to stereo, mono to centre speaker, mono to surround, and various profiles that can be easily switched to when needed. Additionally, you can set push-to-talk, continuous transmission or voice activation detection for the microphone, while altering the environmental sound levels so the listener doesn't pick up a keyboard, for instance.

### Tons Of Options

The user interface is, to begin with, quite sparse. Yet within are a ton of options that most users will probably never touch.

For the sake of my little setup it works a charm, and it's free. If you want to go beyond 32 users, you'll need to look at the licensing options, but for the average home user it's ideal. Incidentally, there's also an option for installing various plug-ins, including one for a G15 Logitech keyboard LCD.

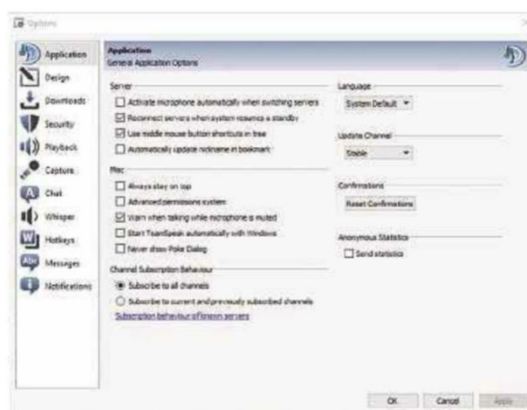
### Conclusion

I admit I may be a bit behind the times when it comes to modern VoIP, especially in the gaming world. TeamSpeak 3, though, is something that's really impressed me and not just from a gaming perspective.

I'm pretty sure there are plenty of small businesses that could benefit from a voice and chat service such as this. [mm](#)



▲ The clean UI hides a complex VoIP setup



▲ There's plenty of options to get your teeth into

# Logging Off

**T**here's a fine line between those companies that generate overblown marketing materials and the true egotists that actually believe it. The irony is that those who generally promote the notion that they're changing the world usually aren't and those who don't often are.

Take, for example, the late Matti Makkonen, who invented SMS messaging, who didn't think his invention was patentable and so never applied for one. And at the other end of the

spectrum is Apple, which has tried to patent rectangles with curved corners, and which thinks everything it makes is 'amazing'. That's not to say that Apple hasn't made the odd world-changing device, but the idea that everything it's made creates an epochal moment just doesn't stand up to much scrutiny.

I've never actually attended an Apple event, mostly because it does them in the USA these days, but also because it never actually invites me.

The ones I've watched outline why I probably wouldn't feel comfortable there even if I did attend. The relationship between the tech press and Apple in the US isn't one I recognise, with the possible exception of the fawning the BBC lavishes on it.

Loud whooping and clapping accompany each reveal and statement like attendees are playing some type of buzzword bingo – one where one more 'incredible' completes a line and wins them a prize!

I saw something similar at the recent Microsoft event, where it announced the Surface Studio, though I believe it had only invited about 100 to 150 journalists, and the rest of the whoopers were 'Windows fans' – if that's a believable label in this age.

These days, I watch these things with more than a hint of incredulity, mostly as to what Panos Panay, Tim Cook and Jonathan Ive have been drinking before they take to the stage to address their faithful. But even by these standards, Apple has exceeded its remarkably high standards for self-congratulation. Having fallen so deeply in love with itself, it recently published a very personal book, a 300-page love letter of sorts, detailing its proudest design moments.

'Designed by Apple in California' comes in two sizes, a larger 13" x 16.3" tome for \$299 and a handy 10.2" x 12.8" edition for \$100 less.

Inside are 450 gorgeously crafted images of Apple products on specially milled German paper, hardback linen covers with a special

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## THIS WEEK'S CROSSWORD

introduction by the breathless Jony Ive. "It is both a testament and a tribute to the meticulous design, engineering and manufacturing methods that are singularly Apple."



Wow. In an interview with Dazed, Jony Ive states that creating this book was a 'responsibility', Apple had no choice in documenting its journey and that it had taken eight years to create it. In making it available it had, in Ive's words, created "a resource for students of all design disciplines."

I should point out that Narcissus (the Greek mythological character who name the word 'narcissist' is derived from) was too obsessed to patent the concept, so there won't be any issue with Apple rebranding it as entirely as its own idea.

We can only hope the market for a \$300 book declaring Apple's unlimited scope for self importance is small and the print run long. And that all the unsold copies are sent to Jony Ive's home where he can luxuriate in his own creative brilliance. Somehow I've resisted the urge to order a copy.

*Mark Pickavance*

## LAST WEEK'S CROSSWORD

**Across:** 7 William Caxton, 8 Extant, 9 Payoff, 10 Ad Astra, 12 Assay, 14 Agile, 16 Adapter, 19 Violin, 20 Woofer, 22 Thigmotropism.

**Down:** 1 Jinx, 2 Always, 3 Capture, 4 Scope, 5 Oxeyes, 6 Conflate, 11 Dogfight, 13 Ad-Aware, 15 La Liga, 17 Prompt, 18 Union, 21 East.

### DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. Okay, we're not political or anything, but we can't help thinking the EU referendum result might have been different if the vote had taken place in winter. Why? Because having had to scrape ice off our windscreen this morning, and spending the entire day working under a blanket, with the very expensive heating

whacked up to maximum, the idea of escaping to, say, Spain or Portugal is particularly appealing right now. Like we say, we're not getting all political on you; we just really hate the winter. That said, there are few good things to look forward to, like sweet peanuts sold by street vendors, mulled wine and fantastic novelty jumpers. There's also Christmas as well, but that's not necessarily something to look forward to, especially if you've got a small amount of money and a large number of relatives. Then, of course, there's New Year's Eve, when you spend far too much money to drink far too much alcohol surrounded by far too many other people doing the same. Bah and, indeed, humbug.

### Across

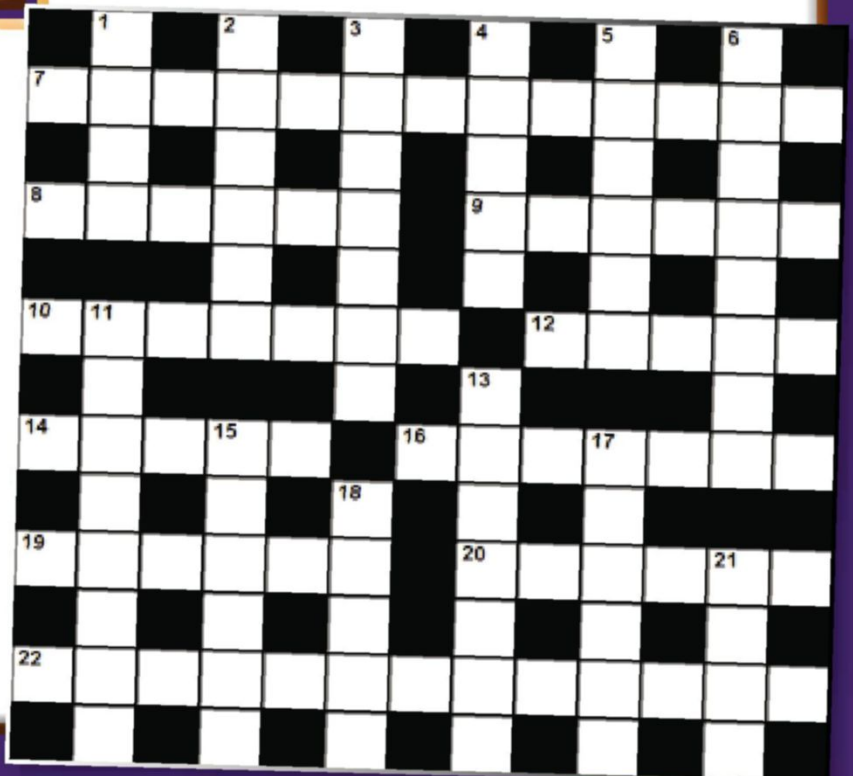
- 7 GCHQ's primary function? (13)  
 8 In Kantian philosophy, a conception of what is common to all members of a class; a general or essential type or form. (6)  
 9 A day off work when supposedly unwell. (6)  
 10 .jm TLD (7)  
 12 A spreadsheet application by Microsoft. (5)  
 14 Taiwanese memory and storage manufacturer. (5)  
 16 In mathematics a way to assign non-negative real numbers to subsets. (7)  
 19 Coldly determined; hard of character. (6)  
 20 In law the legal means to recover a right or obtain redress for a wrong. (6)  
 22 A word, phrase or other form used in informal language. (13)

### Down

- 1 The spreadsheet component of the LibreOffice software package (4)  
 2 Taxonomic groups containing one or more species. (6)  
 3 A sum of money paid before it is due or for work only partly

completed. (7)

- 4 A set of over 80 libraries for C++ that provide support for tasks and structures such as linear algebra, pseudorandom number generation, multithreading, image processing etc. (5)  
 5 US aerospace manufacturer and space transport services company founded in 2002 by former PayPal entrepreneur Elon Musk. (6)  
 6 A person who uses scientific knowledge to solve practical problems. (8)  
 11 A test of the suitability of a performer. (8)  
 13 A stretch of land, especially with regard to its physical features. (7)  
 15 In Mega Man Bass' equivalent to Mega Man's dog, Rush. (6)  
 17 A portion drawn from a population, the study of which is intended to lead to statistical estimates of the attributes of the whole population. (6)  
 18 Very widely used open-source relational database management system. (5)  
 21 The longer of the two telegraphic signals used in Morse code. (4)



# In Next Week's Micro Mart...\*

- ◀ Is a Chromebook right for you?
- ◀ Everything you need to know about the Raspberry Pi
- ◀ The reality of modern VR
- ◀ Plus all the usual news, reviews and more!



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